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ENGINEER OPERATIONS

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PREFACE

Field Manual (FM) 5-100 is the engineer capstone manual. It develops the engineering aspects of doctrine described within FM 100-5 . This manual defines the engineer role within Army operations and provides broad principles for engineer employment throughout the theater of operations (TO). Engineers provide several critical battlefield functions and perform an important role as a member of the combined-arms team.

Engineers adapt terrain to multiply the battle effects of fire and maneuver. This engineer component of the close combat triad (fire, maneuver, terrain) is described within the five engineer battlefield functions: mobility, countermobility, survivability, general engineering, and topographic engineering. Mobility frees the commander from movement limitations imposed by natural terrain or enemy action to allow maneuver of tactical units into positions of advantage. Countermobility directly attacks the enemy commander's ability to execute his plan where and when he desires. Survivability protects the force from the effects of direct and indirect fires throughout the theater. General engineering adds depth in space and time to the battle by ensuring that sustainment operations can occur. Topographic engineering defines and delineates the terrain for planning and operations and provides precise location data to modern efficient weapons systems.

To accomplish these functions, engineers serve throughout the theater, though the bulk of engineer forces are forward within the close operations. As with all arms, engineers are integrated into the scheme of maneuver and are massed at points critical to the battle.

This manual is intended for use by field commanders, staff officers, and the Army school system. Doctrine described in this manual is further amplified in the following published and forthcoming engineer manuals: FM 5-100-15, FM 5-71-100, FM 5-71-100, FM 5-71-2, FM 5-71-3, FM 5-7-30, FM 5-114, FM 90-7, FM 90-13-1, and FM 20-32.

The term *engineer* is all inclusive, from table(s) of organization and equipment (TOE) units to the United States Army Corps of Engineers (USACE).

The proponent for this publication is Headquarters (HQ), United States Army Engineer School (USAES). Submit changes for improving this publication on Department of the Army (DA) Form 2028 (Recommended Changes to Publications and Blank Forms) directly to Commandant, USAES, ATTN: ATSE-T-PD-P, Fort Leonard Wood, Missouri 65473-6650.

Unless otherwise stated, masculine nouns and pronouns do not refer exclusively to men.

CHAPTER 1

Challenges in Army and Engineer Operations

THE NATURE OF WAR

PERSPECTIVE:

> "...it is certain that in future wars, even more than in the past, endeavors will be made by every possible means to prevent or delay the march of the enemy's troops by throwing obstacles in the way and by cutting such lines of communications as they might use.
>
> Conversely, in order to reach an objective, it will be necessary to overcome or destroy obstructions to the movements of troops and re-establish the continuity of highways and railroads in the most rapid and practical manner."
>
> Douglas MacArthur

The United States (US) Army, facing a wide range of potential enemies, is prepared to fight under diverse conditions, climate, and intensity with its sister services and its allies. The range of military operations includes the diverse environments of peacetime, conflict, and war, which are not precise, clearly defined, or exclusive of themselves. Figure 1-1 shows the relationships between peace, conflict, and war.

Conflict, in particular, describes a middle ground that is neither peace nor war. In its lower reaches, conflict includes situations that are generally peaceful, occasionally punctuated by political violence. At its upper end, conflict differs very little from war except in its combination of political and military means. Thus, little is gained by asking if a particular situation is at peace, in conflict, or at war; it should be evaluated on its specific characteristics. The segments of the political-military environments are only central tendencies.

Peacetime operations are those activities that influence the actions that routinely occur between nations. Examples would be engineers involved in humanitarian missions and nation assistance. Peacemaking and peacekeeping operations (PKOs) often involve conflict. Common engineer missions could include route clearance, countermine operations, and force protection. Peacetime operations and conflict are classified as contingency opertions. During contingency operations, the Army faces an environment where it is

States of the Environment	Goal	Military Operations		Examples
War	Fight and win	War	COMBAT	• Large scale combat operations • Attacks • Defenses
Conflict	Deter war and resolve conflict	Other than war	NONCOMBAT	• Strikes and raids • Peace enforcement • Support to insurgency • Antiterrorism • Peacekeeping • NEO
Peacetime	Promote peace	Other than war	NONCOMBAT	• Counterdrug • Disaster relief • Civil support • Peace building • Nation assistance

The states of war, conflict, and peacetime could all exist at once in the theater commander's strategic environment. He can respond to requirements with a wide range of military operations. Noncombat operations might occur during war, just as some combat operations might require combat.

Figure 1-1. Range of military operations

unsuitable to employ the full range of its military might. Political and economic actions will be as important as military force in achieving the desired objective.

War involves the use of force in combat operations against an enemy. In high-intensity and midintensity war, the Army faces large, rapidly maneuvering formations operating on battlefields characterized by sophisticated weapons, high consumption rates, and extended time and distance. Advanced technology provides the capacity to acquire, track, classify, and attack targets at ranges that were unattainable in past conflicts. Integrating automated communications and information systems enhances the command and control (C2) structure's ability to maneuver large forces rapidly. This can occur even if the forces are strained by combat, which mixes forces in nonlinear battles.

World instability can cause the US to react to unfavorable situations with little or no warning. The Army, with its quick reaction forces, must respond rapidly and worldwide in contingency operations through the use or display of force and determination. The danger in a contingency operation is that it could escalate into combat, requiring the Army to either reinforce or extract contingency forces quickly. Also, adding nuclear, biological, chemical (NBC) weapons to the already large array of highly lethal weapons challenges the Army to protect the force, maintain freedom of maneuver, and sustain operations.

THE THREAT

No region of the world is oblivious to potential conflicts, nor can any region maintain complete security, safety, and international equilibrium. Consequently, determining which region will be the next likely area for possible deployment of US forces is difficult. While the threat of global superpower confrontation has been abated, regional power vacuums caused by the breakup of the former Soviet Union are being filled by several contenders. The threats that the US faces are the uncertainty and the unknown, which indicate a period of increased global insecurity.

GENERAL SITUATION

As we enter the 21st century, the international distribution of power and influence in world affairs will be more dispersed than at any time since World War II. The US will remain the leading world power, exceeding other nations in its potential for projecting economic, military, diplomatic, and cultural influence around the globe. While no single nation will radically increase its power compared to the US, many nations will significantly improve their economic and military powers to compete with the US and posture for greater international influence.

Such realignments will result in a new world order characterized by diverse political and military powers and increased economic, and possibly, political interdependence. Transnational and subnational groups, promoting ethnic, religious, economic, cultural, criminal, and other special interests, will become important international actors. Supranational institutions, such as the European community (EC) and large trading blocs in Asia, North America, and the Middle East, can be expected to emerge as major economic and political entities.

The fall of the former Soviet Union has dynamically changed the political world order. However, in today's world, crises and regional wars will continue to challenge vital interest to the US. World peace could again be threatened if any nation or coalition seeks to dominate over the greater concentrations of

industrial, organizational, technological, and human resources within their area of influence.

FOREIGN MILITARY TRENDS

The current global trend is for a nation's military force to become quantitatively smaller but technologically and qualitatively better. Many forces in the world will not become as capable as those of the most technologically advanced nations. However, many nations will increase qualitatively as technology becomes more affordable and available. How well these nations can integrate advanced weapons systems and technology into their armed forces remains to be seen. Yet, the global arms market is creating an environment where even the lesser-developed countries may acquire advanced weapons systems, providing them with high-tech leverage over other regional areas. National economic policies will cause most nations to continue to reduce their overall arms holdings and the size of their armed forces to keep down costs while improving their capabilities.

.

ARMY OPERATIONS DOCTRINE AND ITS FOUNDATION

Army operations doctrine in FM 100-5 is the capstone doctrine that describes how the Army fights. Engineers must master it, since it forms the basis for engineer doctrine contained in this manual. The rest of this chapter covers the fundamentals of Army

operations doctrine as it applies to engineers.

The foundations for Army operations doctrine provide general guidance for the conduct of war. The Army recognizes that the principles of war and the tenets of Army operations are the key operating requirements for success on the battlefield. Engineer operations assist the commander in accomplishing these requirements. The foundations of Army operations doctrine are the principles of war, tenets of Army operations, and dynamics of combat power.

PRINCIPLES OF WAR

The nine principles of war provide the basic framework for the conduct of war at strategic, operational, and tactical levels. The principles are the continuing foundation of Army doctrine. Today's force-projection engineers recognize the following principles of war:

Objective

Direct every military mission toward a clearly defined, decisive, and attainable objective.

Commanders direct the use of available combat power toward clearly defined, attainable, and decisive goals. Engineers analyze how best to support a definable objective and develop courses of action (COAs) to achieve these goals during war and contingency operations. Force commanders then establish the tasks and priorities for all engineer activities.

Offensive

Seize, retain, and exploit the initiative.

Offensive action is the most effective and decisive way to attain a clearly defined common objective. Engineers conduct mobility operations to help the force seize and hold the initiative while maintaining freedom of action and achieving decisive results. Maneuver units and engineers adopt the defense only as a temporary expedient and seek every opportunity to seize the initiative. An offensive spirit must be inherent when conducting all engineer defensive operations.

Mass

Mass the effects of overwhelming combat power at the decisive place and time.

Engineers enable units to concentrate rapidly over clear routes and reduce enemy obstacles without loss of momentum. Engineer forces weight the main effort. Supporting efforts receive remaining engineer support after the main effort is satisfied. Thus, engineer units concentrate in key areas. As the main effort shifts, the engineer force posture enables engineers to shift with it. Because there are not enough engineers to meet all requirements, commanders must minimize their diversion from all but the most essential tasks. Engineer operations require precise integration and synchronization to achieve the desired effects.

Economy of Force

Employ all combat power available in the most effective way possible; allocate essential combat power to secondary efforts.

Engineer units must be judiciously employed and distributed on the battlefield. No engineer unit should be left without purpose. Allocating engineers for missions such as limited attacks, defense, delays, deception, or even retrograde operations is measured to achieve mass elsewhere at the decisive point and time on the battlefield.

Maneuver

Place the enemy in a position of disadvantage through the flexible application of combat power.

Effective force commanders and their engineers thoroughly understand the enemy and its weaknesses. Viable schemes of maneuver consider the capabilities of engineers to alter terrain, reduce enemy obstacles, hinder enemy breaching of friendly obstacles, and protect the force from enemy firepower. Two examples of how engineers enhance maneuver and contribute in destroying the enemy are—

- Combined-arms breaching and clearance operations, which allow the main body to strike at the point of penetration and maintain an aggressive attack.
- Combined-arms obstacle operations, which shape the battlefield and intensify the effects of direct and indirect fires.

Unity of Command

For every objective, seek unity of command and unity of effort.

Engineers at all levels ensure that their units are fully integrated into the combined-arms team. Army engineers also work with those of the other services and agencies to ensure that the total engineer effort brings their full weight to bear in support of the operation.

Security

Never permit the enemy to acquire unexpected advantage.

Engineers are the experts in camouflage, survivability, and countermobility. They support force protection for friendly forces while hindering the intelligence collection efforts of the enemy. Protection¯a dynamic of combat power¯enhances the fighting potential of a force so that the commander can apply it at the decisive time and place. Engineers provide a major role in protecting the force. Constructing hasty and deliberate positions for combat, combat support (CS), and combat service support (CSS) and contributing to the deception plan are two key examples of how engineers enhance security measures.

Surprise

Strike the enemy at a time or a place or in a manner for which it is unprepared.

Engineer mobility and countermobility operations are designed specifically for surprise. Engineers plan and execute obstacles to disrupt the enemy's tempo and freedom of maneuver. Air- and artillery-delivered scatterable mines (SCATMINEs) extend this effect into the enemy's rear area. Engineers provide the mobility to strike the enemy rapidly before it can react. Using engineers in deception operations can be extremely effective due to the visible nature of engineer operations.

Simplicity

Prepare clear, uncomplicated plans and concise orders to ensure thorough understanding.

Simplicity contributes to successful operations. Clear and simple plans minimize confusion and maximize understanding. Simple plans are especially useful when leaders and soldiers are tired from extended operations. These plans enhance a leader's understanding and permit branches and sequences to be understood. Engineer commanders and planners maintain simplicity by ensuring that task organizations and areas of responsibilities allow for smooth transitions and minimal movement. Units are provided clear, concise mission taskings with maximum opportunity for decentralize planning and execution.

TENETS OF ARMY OPERATIONS DOCTRINE

The Army applies combat power by fighting according to the five basic tenets of Army operations doctrine: initiative, agility, depth, synchronization, and versatility.

Initiative

Initiative seeks to set or change the terms of battle by taking action. It requires an offensive spirit, regardless of the nature of the ongoing operation. Initiative requires decentralizing decision authority at the lowest practicable level. Subordinates at all levels understand the commander's intent and the

assumptions on which he bases it. They act independently within the framework of this intent. Engineers must be very adept for their support to be timely. Their tasks are often time-consuming and frequently resource-intensive. Engineers understand the commander's intent, anticipate the requirements for a mission, and initiate preparatory actions before their need is often perceived, in detail, at higher echelons.

Agility

Agility is the ability of friendly forces to act faster than enemy forces. It permits a friendly force to seize and hold the initiative. Commanders risk commitment without complete information. Engineers are task-organized to ensure rapid response to changing requirements. They shift support for the main effort with minimum delay and with the least possible reconfiguration and coordination.

Depth

Depth is the extension of operations in space, time, and resources. Engineers provide support throughout the entire TO. In the offense, they add depth to the friendly forces' attack by rapidly reducing the enemy's obstacle systems and fortifications to maintain a high rate of advance. In the defense, engineers add depth to the battlefield by altering the terrain, thereby increasing the time and cost of operations to the enemy. In all operations, engineers keep open the lines of communication (LOC) that make the shifting of forces and the forward movement of reserves and other resources possible.

Synchronization

Synchronization brings time, space, and purpose together to produce the maximum combat power at the decisive point. Battles involve many elements that must mesh together as a whole. Engineer actions often require significant lead time for successful integration with the rest of the combined-arms team. Therefore, engineers synchronize their activities carefully so their effects are felt at the decisive time and place and in the desired manner.

Versatility

Versatility is the ability of units to meet diverse mission requirements. Engineers must be able to shift focus, tailor forces, and move from one role to another rapidly and efficiently. Their units must be able to transfer quickly their combat-engineer skills to other tasks, such as repairing and constructing infrastructures or restoring utilities. Versatility is the ability to perform in many roles and environments during war and contingency operations. Technical and tactical competence is required for the engineer commander to be versatile. Engineers must be prepared to conduct multiple operations in multiple-operational environments at the same time.

DYNAMICS OF COMBAT POWER

Army operations recognize the dynamics of combat power—maneuver, firepower, protection, and leadership—which, by skillful combination at the right place and time, defeat the enemy.

Maneuver

Maneuver depends on mobility to mass forces, attain surprise, reduce vulnerability, exploit success, and

preserve freedom of action. Commanders maneuver their forces into positions of advantage over the enemy. As the commander's terrain experts, engineers analyze the terrain to determine maneuver potential, which enhances the maneuver. They swiftly reduce natural and enemy obstacles to maintain freedom to maneuver where desired, not just where the enemy allows.

Engineer units, when organized and equipped to move with other members of the combined-arms team, ensure mobility when and where it is needed. Equally important, engineers deny freedom of maneuver to the enemy by enhancing the inherent obstacle value of terrain.

Firepower

Commanders mass fires on the battlefield by rapidly positioning weapon systems for concentrated fires on lucrative enemy targets. Engineer terrain analysis helps determine the likely avenues of approach (AAs) and select the engagement areas (EAs). Engineer obstacle systems disrupt the integrity of enemy formations, turn them into EAs, and fix the enemy in these areas by prolonging its exposure to fires, thereby increasing its losses. Tactical minefields, emplaced by engineer units, add their destructive effects to massed direct and indirect fires while holding the enemy in EAs. Engineer units with rapid obstacle-emplacement capability respond quickly to changing situations on a dynamic battlefield.

Protection

Protection, which includes cover, concealment, deception, and operations security (OPSEC), makes the force's soldiers, systems, and units difficult to locate and attack. Engineers protect the force by developing fortifications and shelters that enable units not only to survive but also to fight in positions that would otherwise be untenable due to enemy fires. Engineer units, using mobile, rapid digging and construction capabilities, prepare weapons emplacements, vehicle fighting positions, and bunkers. Engineers also assist in camouflage measures and in preparing concealed routes. They work so that the signature they present to the enemy supports the deception plan, which also adds protection.

Leadership

Engineer leaders at all levels ensure that their units are fully integrated into the combined-arms team. Engineers give maneuver commanders options, not otherwise available, that aid them to be bold and daring by minimizing their risks and enhancing the mobility of their forces. Timely engineer advice helps maneuver commanders make critical choices within the enemy's decision cycle. Engineer leaders ensure that their units are well-motivated, well-trained, and well-disciplined to withstand the stress of the battlefield and carry out their missions.

DEEP, CLOSE, AND REAR OPERATIONS

Deep, close, and rear operations require continuous synchronization. Engineers participate at all echelons in the planning and coordination process to ensure that these operations support the overall battle.

DEEP OPERATIONS

Deep operations consist of activities directed against enemy forces not in contact to influence the conditions under which future close operations will take place. Deep operations are often conducted with assets other than ground-maneuver forces. In these cases, engineers provide terrain analysis to aid the commander in the intelligence preparation of the battlefield (IPB). Knowing the impact of terrain on weapons effects, they participate in the target analysis/nomination process to help the commander shape the battlefield. Engineers also provide advice on using interdiction obstacles and tracking their status in the commander's area of interest for future operations. Whenever ground forces conduct deep operations, engineers open and maintain necessary routes and aviation facilities to support the action.

CLOSE OPERATIONS

Close operations consist of activities that support the current fight against enemy forces in contact. At the tactical level, all engineers fighting as part of a committed division are involved in close operations. Only ground forces can dominate the terrain through close operations. Engineer forces are part of a maneuver commander's ability to choose where, when, and against whom to commit assault formations.

REAR OPERATIONS

Rear operations assist in providing freedom of action and continuity of operations, logistics, and battle command. Their primary purposes are to sustain the current close and deep fights and to posture the force for future operations. Rear areas may not be contiguous with forward areas, complicating both protection for rear-area forces and sustainment of forces fighting close operations. Therefore, engineers provide hardened shelters and protective obstacles and assist in camouflage measures. A major task is to acquire, build, and maintain the facilities and transportation networks for LOC that are critical to rear operations. Engineers may also be required to support area damage control (ADC).

THE ENGINEER FOCUS

Engineer commanders focus on the objective during war and contingency operations. In war, engineers focus on—

- Mobility by primarily conducting combined-arms breaching, route clearance, and other mobility and general-engineering tasks.
- Countermobility by conducting combined-arms obstacle operations and other countermobility tasks that attack the enemy's ability to maneuver on the battlefield.
- Survivability by conducting defensive preparations for combat, CS, and CSS vehicles and personnel. Engineers construct survivability positions to protect forces from detection and direct and/or indirect fires.
- General engineering by maintaining LOC and other tasks that allow forces to move and sustain throughout the area of operation (AO).
- Topographic engineering by providing terrain analyses and products that assist the commander in visualizing the battlefield and predicting the effects of terrain on military operations. In contingency operations, engineers focus on all of the above (see Chapter 12 for more information

on the battlefield functions). They conduct a wide range of tasks throughout the depth of an operation. Engineer units come in different forms with unique capabilities. Their functions allow forces to maneuver, countermaneuver, and sustain in any environment. Later chapters will describe doctrinal guidelines on engineer operations during war and contingency operations.

THE ROLES OF ENGINEERS

The changing nature of war and Army operations doctrine pose great challenges. Engineer integration into staff planning requires increased emphasis, since synchronizing the battle is increasingly complex. Engineer C2 must function rapidly to be responsive on a dynamic battlefield. A terrain analysis and its products assist in faster planning. Requirements for fortifications and protective shelters increase. Obstacle systems retain their importance. Most important, obstacle breaching and rapid gap crossing have greater emphasis than in the past.

The five primary engineer functions in the TO are mobility, countermobility, survivability, general engineering, and topographic engineering. Figure 1-2 shows the types of engineer missions by battlefield function.

MOBILITY

Mobility enables the force commander to maneuver tactical units into advantageous positions over the enemy. In the attack, engineers aggressively execute drills to breach enemy obstacles and assault and destroy enemy fortifications. The commander designates routes for ground forces, well in advance of their intended use, so that engineer units can upgrade the routes, as necessary, and keep them open or repaired. Engineers also prepare field sites that the Army and Air Force aviation assets use to support an operation. (See FMs 5-101, 90-13, and 90-13-1 for more information on techniques and procedures for mobility.)

COUNTERMOBILITY

Countermobility augments natural terrain with obstacle systems according to the commander's concept. This adds depth to the battle in space and time by attacking the enemy's ability to maneuver its forces. With its movement disrupted, turned, fixed, or blocked, the enemy is vulnerable to our forces. Engineers advise the commander on the best means to reinforce the terrain and emplace obstacles that support his plan. (See FMs 5-102, 20-32, and 90-7 for more information on tactics and techniques for countermobility.)

SURVIVABILITY

Survivability provides concealment and protective shelter from the effects of enemy weapons. Engineers

- Have the technical knowledge, skills, and equipment to assist other units in developing defensive positions into fortifications and in improving defensive positions.
- Provide technical advice on camouflage.
- Dig fighting positions beyond the combat units' organic capabilities.

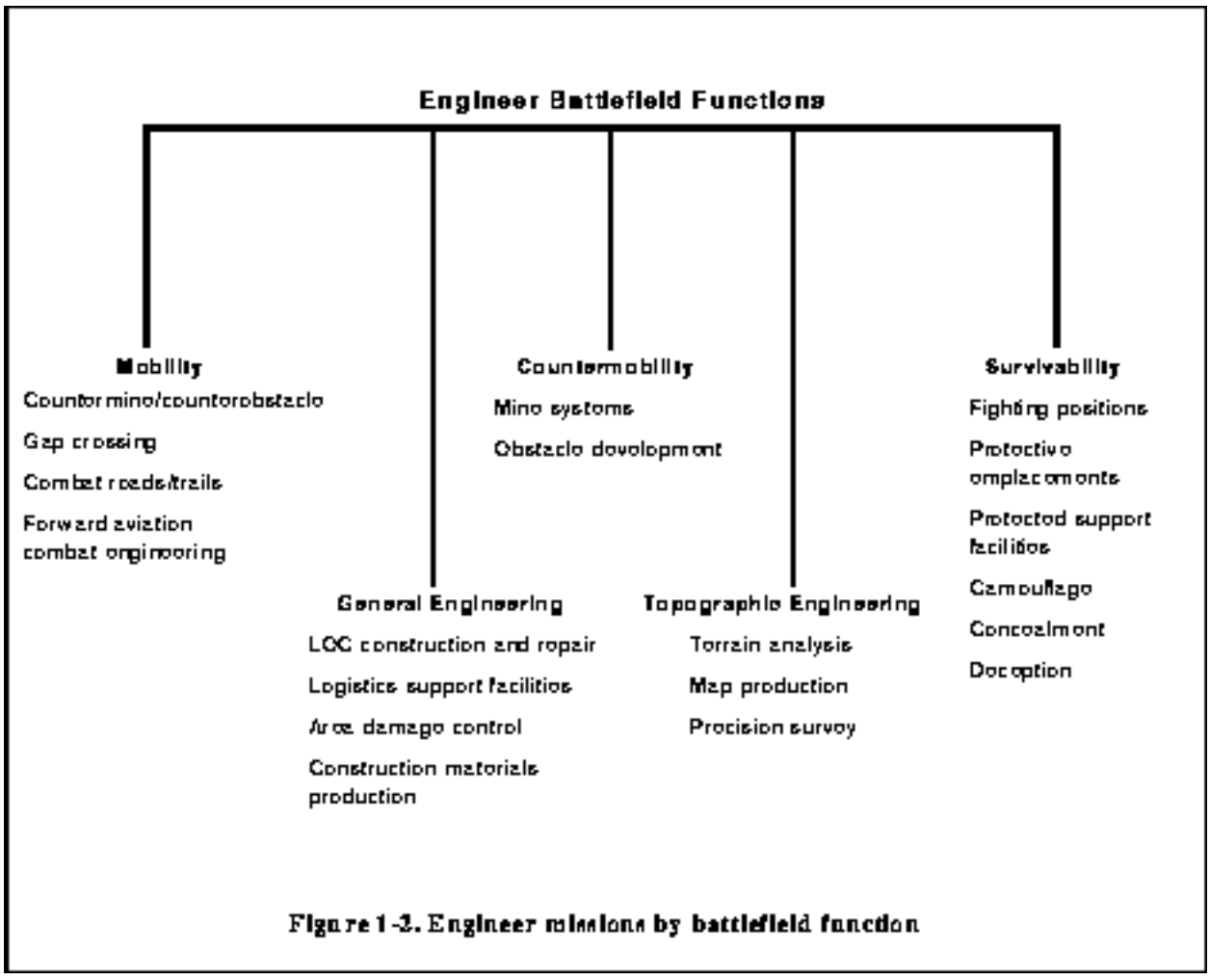


Figure 1-3. Engineer missions by battlefield function

- Harden facilities to resist destruction by the enemy.
- Provide equipment support necessary to establish NBC decontamination points and assist in route and area decontamination. (See FM 5-103 for more information on techniques and procedures for survivability and for conducting survivability operations.)

GENERAL ENGINEERING

General engineering helps establish and maintain the infrastructure necessary for sustaining military operations in theater. General-engineering tasks—

- May include construction or repair of existing logistics-support facilities, supply routes, airfields, ports, water wells, power plants, and pipelines.
- May be performed by a combination of joint engineer units, civilian contractors, and host-nation (HN) forces.
- Usually require large amounts of construction materials, which must be planned and provided for in a timely manner. (See FM 5-104 for more information on techniques and procedures for general engineering.)

PERSPECTIVE:

On the second day of the Battle of Gettysburg, the Union commander, General George Meade, sent his engineer, Gouvernor Warren, to examine his left flank. Both Meade and Warren were concerned about that part of the Union lines because of Confederate activity. Upon arriving on a small elevation called Little Round Top, Warren discovered that the hill was unoccupied except for a few signal men. In the distance, he could see advancing Confederate infantry. He immediately sent messengers to nearby commanders and urged them to move quickly to fortify the hill. Ultimately, Vincent's brigade of the V Corps moved up. The Union forces arrived only minutes before the Confederate troops. In a desperate battle, which raged for several hours, Union infantry and artillery successfully defended the position against repeated Confederate charges. Had the Confederates taken Little Round Top, they could have turned the Union flank and rolled up the Union lines. The resulting disaster could have altered the outcome of the Civil War.

TOPOGRAPHIC ENGINEERING

Topographic engineering provides commanders with information about the terrain. Terrain information allows a commander to visualize the battlefield environment better and to position forces. All engineers are terrain analysts and assist others to use the ground effectively.

In particular, they recommend avenues and routes, obstacle locations, EAs, unit positions, and deep-operation targets. Topographic engineer units use digital terrain data to develop a detailed terrain analysis. (See FM 5-105 for more information on topographic-engineering techniques and procedures.)

ENGINEERS AND TECHNOLOGY

Technology of the 21st century will demand a 21st-century engineer soldier equal to the sophisticated systems of the future. Only intelligent, physically fit, highly motivated, educated, and well-trained engineers can leverage technology to its full potential. Electronic connectivity between and among all echelons in the Army will result in such speed and precision in communications that operational- and tactical-situation awareness and agility will far exceed that of today's forces. By 2010, the battlefield will be *digitized.* Incorporating digital technology will give commanders unprecedented capabilities to gather and share tactical information. Engineers will provide three-dimensional virtual terrain products of the battle space for all forces.

Future digitized engineer units will be able to quickly task-organize limited engineer systems, such as the following, to support the commander:

- Standoff minefield-detection systems, which will provide near real-time obstacle intelligence.
- Digital in-stride and deliberate breaching and lane-marking equipment, which will increase synergy and survivability on the battlefield.
- Emplaced-obstacle planning and control, which will be enhanced through digital communications links.
- Intelligent minefields with turn-on/turn-off and sensor capabilities, which will provide real-time intelligence along with increased situational awareness to the combined-arms team.
- Digital position-navigation systems, which will positively mark survivability positions on the battlefield and allow for efficient use of scarce engineer digging assets.
- Laser-leveling technology, which will continue to improve employing engineer construction equipment. New technology will demand more of engineer leaders, but the fundamentals of leadership will remain the same. The engineer leaders of 2010 will be masters of information technology. No matter how much technology, weapons, and organizations change, the engineer leaders and soldiers of 2010 will find some things unchanged. Character, commitment, courage¯these values will still be the hallmark of the Army engineer.

CHAPTER 2

Fundamentals of Engineer Operations

BATTLE COMMAND/C2

Command is truly an art and a science. Commanders are challenged to inspire soldiers in the most difficult of situations. Combat leadership requires a special blend of discipline, courage, and skill. Battle command¯

- Is the art of battle decision making and leading and motivating soldiers and their organizations into action to accomplish missions at the least cost to soldiers.
- Includes visualizing the current state and desired future states and then deciding on how to get from one to the other.
- Demands that leaders position themselves where they can best command without depriving themselves of the ability to respond to changing situations. The commander must be able to go where he can best assess the operation and risks and make the necessary adjustments. Command¯the art of motivating and directing soldiers¯must be supported by the means needed to regulate the forces to achieve the commander's intent. However, commanding, decision making, and problem solving that come with it are not done in isolation. The commander's staff and subordinates assist in developing, modifying, and improving COAs and in developing future COAs for events that are not totally clear. Commanders make estimates of future operations and assessments of the current situation to determine their own intent and formulate the concept of operation. Prioritizing actions and considerations for the acceptable degree of risk guides the commander in determining the amount of control he can, and should, delegate to others to synchronize actions across the AO.

  Control is inherent in battle command. It is monitoring the status of organizational activities, identifying deviations from the commander's intent, and regulating the forces and means toward an intended aim. Commanders apply means to accomplish their intent. Ultimately, commanders provide methods to measure, report, and correct performance. Control serves its purpose by allowing the commander the freedom to operate, delegate authority, and lead from any critical point on the battlefield while synchronizing actions throughout his AO.

  The process of controlling an organization is directed towards ensuring that all of the pieces pull together, adjusting as the situation dictates but never losing sight of the intended end state and

purpose of the mission—the commander's intent. Battle-command systems must support the ability of the commander to adjust plans for future operations, even while focusing on the current fight. Skilled staffs work within the commander's intent to direct and control units and allocate the means to support the intent.

COMMAND AND SUPPORT RELATIONSHIPS

As a significant part of the tactical-planning process, the staff recommends the appropriate command or support relationship between engineer and maneuver units to the commander. Each situation is unique and requires its own solution. Whatever the relationship, engineer commanders are always responsible for the technical correctness of all tasks accomplished by their subordinate elements.

COMMAND

Command authority over engineer units is given to a maneuver commander when he requires immediately responsive engineers. This authority is well suited for fluid situations, such as exploitations and pursuits. The command relationship can be attachment, operational control (OPCON), or operational command (OPCOM).

Attachment

Attachment is recommended when—

- A subordinate maneuver commander needs task organization or direct-command authority over engineer units.
- Time, distance, or communications prevent the parent engineer HQ from providing adequate logistical support.
- The above factors keep the parent engineer unit from making timely command decisions. Engineer units attached in this manner often need an accompanying support slice from logistics elements. The attachment must occur early to enable full integration into the maneuver force.

Operational Control

OPCON is appropriate when a subordinate maneuver commander needs task organization or direct-command authority over engineer units and the parent engineer HQ can provide continued logistical support. The parent engineer unit coordinates with logistics organizations to make this viable.

Operational Command

OPCOM is appropriate when an engineer unit supports another service in a joint operation. In this case, OPCOM is synonymous with OPCON concerning command, administrative, and logistical responsibilities. OPCOM may also be used for combined operations in the North Atlantic Treaty Organization (NATO).

SUPPORT

Command, administrative, and logistical responsibilities remain with the parent engineer unit in a support relationship. The engineer unit commander organizes the unit and suballocates tasks so that they will effectively meet the needs of the maneuver commander.

Direct Support (DS)

A DS relationship is appropriate when the subordinate maneuver commander needs a high degree of responsiveness from engineers but does not need task-organization authority. A higher HQ will often use this relationship when it anticipates a change to the engineer task organization that will require shifting engineer units to other locations. This relationship precludes further task organization of the engineer unit by the supported maneuver commander.

General Support (GS)

A GS relationship is appropriate when the higher HQ requires central control and flexibility in employing limited engineer forces. Engineers in the rear areas are usually employed in GS.

TASK ORGANIZATION

Engineer platoons work most efficiently under the control of an engineer company, and engineer companies work most efficiently under the control of an engineer battalion. This permits close control and the most productive use of all engineer assets. The engineer commander continuously monitors the progress of assigned tasks and shifts elements where the need is greatest throughout his AO.

The maneuver commander gets a better response when the engineer battalion, company, or platoon is under his direct control. He determines the task organization and gives missions directly to the engineer elements under his control. He gets quicker results but at the cost of decreased engineer flexibility to the higher maneuver commander.

Whether engineers are in a command or a support relationship to a maneuver HQ is a balance between the needs of the higher commander or the subordinate commander. The former needs engineers for flexibility and the most efficient use of scarce engineer assets. The latter needs engineers for responsiveness and the ability to task-organize his forces. Army operations doctrine requires subordinate commanders to seize the initiative whenever they can.

Normally, the corps commander provides each committed division with a corps combat-engineer group in a command relationship. Additional corps engineers are usually in a support relationship. The heavy division engineer brigade can then task-organize and provide adequate engineer support to its committed maneuver brigades while additional engineers accept missions in the division's rear. Divisions allocate engineers in DS to those brigades not in contact. For maneuver brigades already in contact, or when contact is imminent (maneuver commander flexibility is vital), the division should allocate engineer battalions in an attached or OPCON status. The brigade engineer, in turn, can provide engineers directly to his battalion task forces (TFs) only when he receives the engineers from the division in a command relationship. Otherwise, the engineer commander determines the deployment of his subordinate elements.

PERSPECTIVE:

Lieutenant Colonel Thomas Riggs, 81st Engineer Combat Battalion, received orders from the 106th Infantry Division to establish a line east of St Vith and hold off the Germans. He rounded up all available men of the 81st and 168th Engineer Combat Battalions and managed to hold off the Germans until 21 December when they broke up into small groups and attempted to make their way back to St Vith. Colonel Riggs was captured, but he escaped to Poland and fought with the Russians until he returned to his unit in April 1945.

CONTROL

A commander maintains control of subordinate elements directly by his presence at critical events and indirectly through his HQ. The first is an exercise in leadership, as described in FM 22-100. The second depends heavily on the commander's staff and organization, while also relying on his leadership.

The maneuver commander at each echelon uses his HQ to control combat operations, but he relies on engineer C2 elements to ensure that engineer units successfully execute the tasks that he assigns to them. Engineer C2 elements consist of the engineer member of the maneuver commander's battle staff, subordinate engineer unit commanders, and the staffs of those subordinate units.

USE OF ENGINEER HQ

Maneuver commanders assign the AOs for their subordinate units. Those same boundaries are also the basis for assigning AOs to engineers. When developing COAs in the tactical-planning process, the engineer planner allocates an available subordinate HQ to control engineer units. Whenever possible, the engineer planner aligns his operational boundaries with those of the maneuver forces, which is very important at the division level.

Commanders task-organize engineer units based on their estimate of the situation. An engineer company can command up to two additional engineer platoons. An engineer battalion can command up to five engineer companies. These can be a mixture of corps and divisional elements operating under either a corps or a divisional engineer HQ.

An engineer HQ often functions as a combined-arms HQ. An engineer platoon can incorporate tanks with mine plows for a breaching mission. An engineer company might be the breach force for a TF deliberate breach and have an attached tank platoon and attached mechanized infantry platoon. An engineer battalion might be the breach force for a brigade deliberate breach and have an attached tank/mechanized company/team plus air-defense assets. A division engineer brigade may have a special role in a major river-crossing operation and have attached to it a large number of military police, chemical, and intelligence units, as well as engineer units.

The engineer command (ENCOM) uses the theater contract construction agency (CCA) elements to provide contract construction and real estate operations. The CCA has area familiarity and habitual relationships within the theater and often maintains a forward presence in the area before contingency operations. USACE forward's (Fwd's) structure and capability are provided in theater. USACE may have a small HQ staff for controlling of one or more area offices and other dispersed teams while also maintaining communications to the parent HQ for technical and administrative support purposes.

Engineer Command

The ENCOM is a major subordinate command of the Army service component commander (ASCC) and provides C2 and a central organization framework for the operational-level engineer effort in theater. (Figure 2-1 shows a notional ASCC engineer theater laydown.) The ENCOM focuses on reinforcing and augmenting corps engineer efforts and developing the theater-support base. This focus involves planning, ensuring operational mobility, and coordinating all operational-engineering assets. It also involves command direction of topographic operations, construction, real-property maintenance activities (RPMA), LOC sustainment, engineer logistics management, and base development.

Theater-construction management often spans multiservice requirements. The unified or specified commander (commander in chief [CINC]) may direct establishing a regional contingency-engineering manager (RCEM) to control all theater-level engineering. The ENCOM can perform this role if the CINC designates the ASCC as the RCEM and the ASCC designates the ENCOM as its agent. An ENCOM may deploy by increments to meet highly variable work loads and situations.

Theater Army (TA) Engineer Brigade

The TA engineer brigade is the principal subordinate unit of the ENCOM. It commands and controls an engineer group HQ and engineer battalions, companies, detachments, and teams to meet varied operational-engineering requirements. The TA engineer brigade's AO normally coincides with the theater logistics command boundaries. The TA engineer brigade normally receives engineer work requests directly from the theater logistics command HQ and ENCOM. The TA engineer brigade's C2 capability is similar to the ENCOM's except for topographic-support functions.

Corps Engineer Brigade

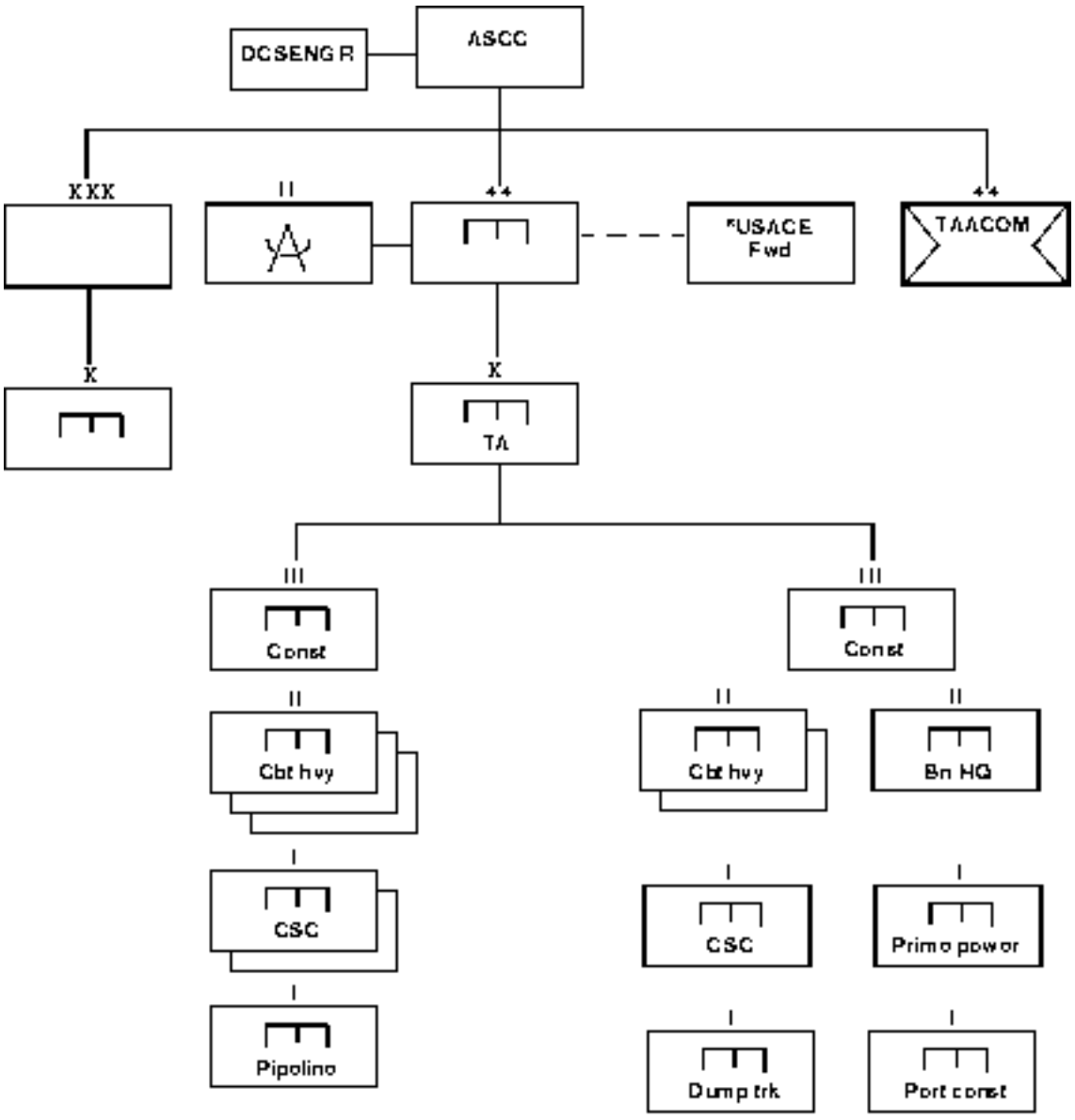
The brigade staff aids the corps engineer in his roles of commander and special staff officer. The assistant corps engineer integrates engineers into the corps's plans. The rest of the engineer brigade staff completes the detailed planning necessary to implement the tasks assigned by the corps's order. The staff mainly acquires and positions resources needed for future operations. It is limited in coordinating the activities of the brigade's subordinate groups or battalions and in solving problems that hamper completing tasks critical to corps operations.

The brigade staff enables the commander to control engineer units in the corps's rear and sends resources forward to committed divisions, as needed. The brigade assigns portions of the corps's area to its subordinate engineer groups. These groups are positioned behind each committed division. Occasionally, the priority division may need a large number of corps engineers that an entire engineer group operates within the area. (See Figure 2-2 for a notional corps engineer brigade laydown.)

Engineer Group

The engineer group is responsible for the area that the brigade assigns. The engineer group is employed when the span of control, due to distances or numbers of engineer battalions, makes direct control by the brigade ineffective.

Division Engineer Brigade



*TDA element

Figure 2-1. Notional ASCC theater engineer laydown

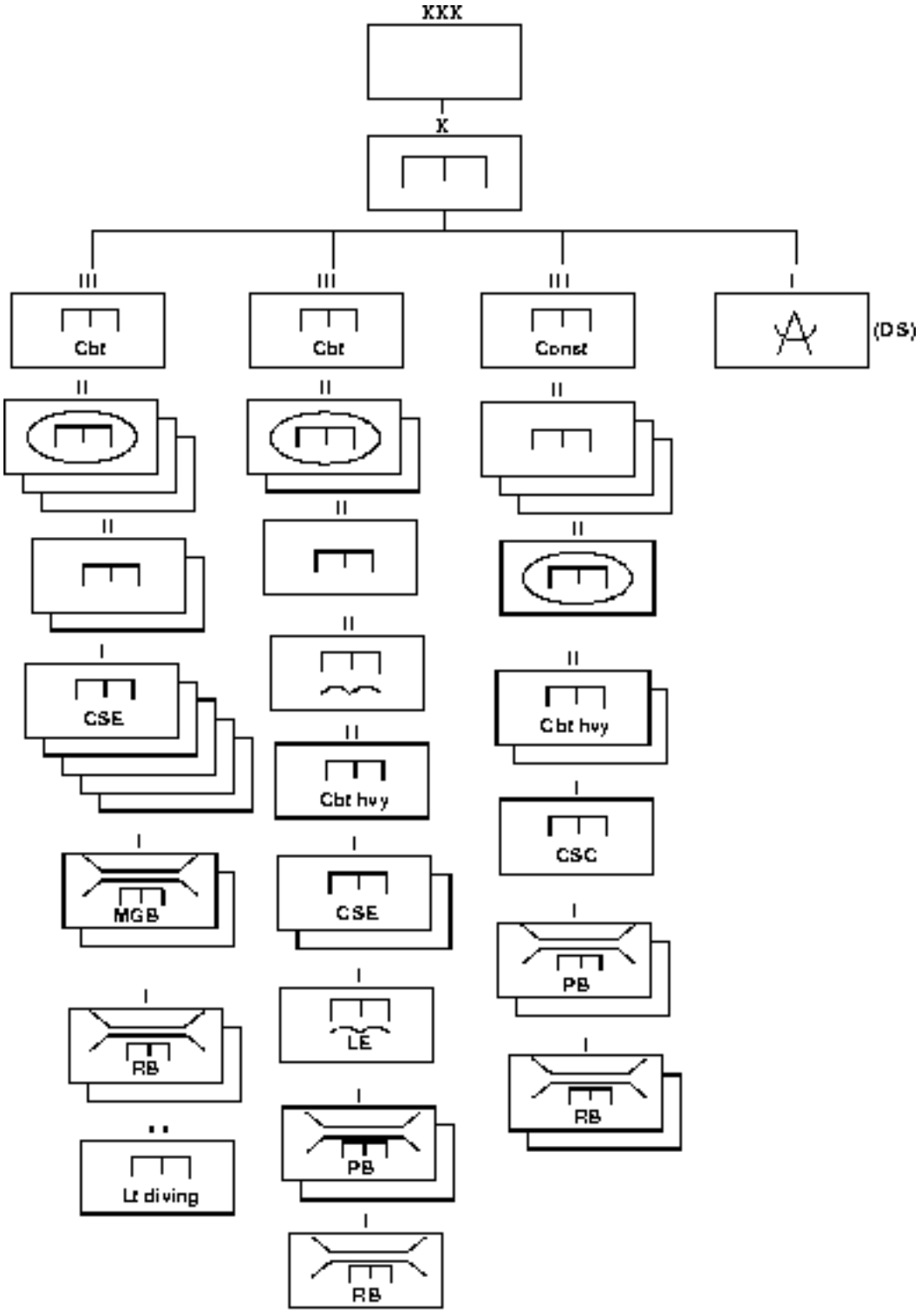


Figure 2-2. Notional corps engineer brigade laydown

As with the corps, the brigade staff aids the division engineer in his roles of commander and special staff officer. The assistant division engineer (ADE) integrates engineers into the division plan, and the remainder of the brigade staff does the detailed planning to support it. The brigade staff ensures that adequate administrative and logistical support is available for its engineer battalions. It solves logistics problems that prevent completing any critical engineer task within the division, whether performed by division or corps units. The brigade staff integrates engineers into rear operations.

Division Engineer Battalion

The engineer battalion HQ can control division or other corps units besides its own. The command or support relationship established in the division order determines how a battalion can employ engineer assets in its area.

When given to the brigade in a command relationship, the battalion HQ can be an engineer control HQ for a maneuver brigade. The priority maneuver brigade may have up to five engineer companies operating in its area. The battalion HQ gives the brigade the capability to fully use additional engineer assets effectively.

Engineer Company

The company is the lowest engineer echelon that can plan and execute 24-hour-a-day operations in support of maneuver forces. The company is ideally suited for integrating into maneuver TF operations. It provides the TF with an engineer HQ to provide C2 for organic and attached engineers and other units to execute engineer-oriented missions. The company also accomplishes brigade tasks independent of TF operations. For this, it is under the control of the engineer battalion.

Engineer Platoon

The engineer platoon is the lowest level that an engineer unit can still effectively accomplish independent tasks. For that reason, engineers rarely operate in smaller increments. If they do, it is for specific actions of limited duration. Usually, the platoon operates under the control of an engineer company; however, it can be placed in a command or support relationship to a maneuver company/team.

ENGINEER COORDINATION

Engineers often coordinate operations within an area by using area or task assignments. These supplement the command or support relationship; they are not a substitute.

Area Assignment

Engineers in a command or support relationship with a maneuver unit assume responsibility for that unit's AOs, unless the order states differently. The staff engineer at each echelon ensures that area responsibilities are clear. Wherever possible, area assignments follow maneuver unit boundaries in the combat zone (CZ) and the theater army area command (TAACOM) boundaries in the communications zone (COMMZ).

Task Assignment

Specific engineer units can have tasks that may or may not cross unit boundaries. Supply-route maintenance and pipeline construction are examples of coordination by task assignment.

ENGINEER INFORMATION FLOW

Accurate, timely information is vital to effective C2. Engineers use information of both an operational and a technical nature. They communicate through operations channels to keep their higher HQ informed on current missions and to plan future ones. Engineers communicate through engineer channels for technical information and as a way of passing operational information that is not time-sensitive. Unit standing operating procedures (SOPs) identify the type and frequency of reports needed at each echelon and the method for reporting.

Unit Status

Unit capabilities depend on the status of personnel, equipment, logistics, and training. Since these all fluctuate in the course of an operation, decision makers must have current information on hand. Maneuver commanders only need to know the engineer-unit status in broad terms. Engineer commanders and staff officers need detailed information to remedy specific deficiencies and make plans for a unit to execute them.

Mission Status

Operations do not always proceed exactly according to plan. Maneuver and engineer commanders need to know the progress of an operation. Engineers keep the immediate commander informed on critical tasks, such as reducing an enemy obstacle or emplacing a scatterable minefield. They also forward technical information upward and laterally for other engineers to take action.

Terrain Information

Engineers provide and analyze terrain information to assist in operational planning. They continuously update known information by all available means, especially from reports from subordinate engineer elements. Frequently, a proposed operation will generate engineer-specific requirements for specialized engineer reports, such as route or obstacle reconnaissance.

Army Battle Command System (ABCS)

The ABCS enables Army commanders to employ and sustain forces in the TO. It uses computer technology to disseminate and analyze information. Part of the system is the Army Tactical Command and Control System (ATCCS), which automates C2 functions at corps level and below. The Army Global Command and Control System (AGCCS) automates C2 functions at corps level and above. AGCCS and ATCCS overlap at corps level. Most combat-engineer automation under ABCS is a subfunction of the Maneuver Control System (MCS). Thus, engineer operations fall directly in line with maneuver-reporting requirements. Topographic-engineering automation is a subfunction of the intelligence and electronic warfare node. The Combat Terrain Information System (CTIS) interfaces with this node.

Control

Control is the process by which commanders employ or direct the combat power of assigned or supporting units. The authority to control is derived from command responsibility. Commanders exercise control by directing operational concepts, task organization, mission orders, graphic overlays, SOPs, control measures, and supply and other asset allocations to their staff and units. During operations, commanders exert control by activating preplanned situational responses, such as committing reserves or executing situational obstacles or by revising plans. Commanders must develop organizations so they can exert control from anywhere within the AO.

Control is a top-down process. The most important requirement is to establish a clear and precise concept of the operation based on an accurate estimate process. The concept must have—

- A clear intent that encompasses why the engineer operation is necessary to support the force commander.
- An achievable end state.
- A statement of how the engineers will achieve the mission. At the highest level, the concept of the operation provides a focus for all operations and extends the commander's intent throughout the entire force. Orders at high levels will normally assign broad missions, control measures, and assets. At the lower levels, commanders will assign specific tasks that align with the concept of the operation and its control measures, using the assets provided above. Orders must promote initiative and innovative solutions and allow for exploitation of success.

ROLES OF ENGINEER COMMANDERS AND STAFF ELEMENTS

Engineers at each echelon provide information, make routine decisions within the authority that the commander gives them, and perform staff supervision of engineer operations.

ASCC ENGINEER

The ASCC staff normally includes the ASCC engineer. He is a member of the ASCC commander's special staff. He integrates engineers into the ASCC's plan to sustain Army forces and support other services or allied forces. The senior operational-level engineer commander is the ASCC engineer.

CORPS ENGINEER

The commander of the corps engineer brigade is the corps engineer. He plans and executes engineer operations in the corps's area. As the engineer brigade commander, he commands all nondivisional engineer units in the corps. As the engineer special staff officer, he is responsible to the corps commander for all engineer-related matters in the corps's AO.

The brigade commander has a staff element located in the corps's command posts (CPs). This staff is under the direction of the assistant corps engineer, who integrates engineers into the corps's planning process. The assistant corps engineer provides advanced warning of future corps operations through

engineer channels to the corps engineer brigade, division engineer brigade, separate brigades, and armored-cavalry-regiment (ACR) engineer companies. He receives reports from these levels to keep the corps staff informed on current engineer operations.

DIVISION ENGINEER

The commander of the division's organic engineer brigade or engineer battalion is the division engineer. He plans and executes engineer operations in the division area. The division order often gives control of the elements of the engineer brigade to the maneuver commanders, yet the division engineer retains his command responsibilities and employs those elements left under his direct control. As the engineer special staff officer, he is responsible to the division commander for all engineer-related matters in the division's AO. The division engineer remains so regardless of the rank of the senior corps engineer unit commander in the division's area. Corps engineer units in the division's area provide liaison to the division engineer.

To assist the commander in his role as a special staff officer, the division engineer has a staff element located in the division's CPs. It is under the direction of the ADE, who integrates engineer operations during the division's planning process. The ADE provides advanced warning, through engineer channels, of future division operations to the division and supporting corps engineer battalions and to the maneuver brigades. He also receives reports from these levels to keep the division staff and the corps engineer informed on current engineer operations in the division.

With the assistance of his staff, the division engineer controls corps units in the division area. The ADE passes division taskings to corps engineer units on behalf of the commanding general (CG).

BRIGADE ENGINEER

In an armored or mechanized division, the organic engineer brigade generally provides an engineer battalion to each ground-maneuver brigade. In a light, air-assault, or airborne division, the organic engineer battalion provides an engineer company to each maneuver brigade. The respective engineer battalion commander and company commander assume the brigade engineer responsibility. The brigade engineer integrates engineers into the brigade's planning process and coordinates current engineer operations in the brigade's area. As the brigade engineer, he commands all engineer units in the brigade. As the brigade engineer special staff officer, he is responsible to the brigade commander for all engineer-related matters in the brigade's AO. Separate maneuver brigades and ACRs have a staff engineer organic to the brigade or regiment.

BATTALION/TF ENGINEER

The brigade engineer often establishes a normal association between an engineer company and a maneuver battalion. Maintaining that association is one factor to consider in the tactical-planning process, since there are advantages to the company commander functioning as the TF engineer. The company commander normally associated with a battalion/TF is also the staff engineer and advisor to the task-force commander (TFC). The company commander has a small HQ section to assist the TFC in integrating engineers into the TF's planning process and in executing the engineer portion of the operation. He makes operational reports through the TF Operations and Training Officer (US Army) (S3)

and provides other required reports through engineer channels, as necessary.

When additional engineers operate with the TF, the normally associated company commander remains the TF engineer. However, the other engineer unit commander and his staff assist in detailed planning.

ENGINEER ECHELON ARCHITECTURE

Strategic objectives, the nature of the TO, and the forces available influence the design of the theater commander's campaign plan. The requirements for engineers and the types of organizations, which come from this plan and drive the engineer architecture, vary from one theater to another. Organizational principles derived from Army operations guide the organization of engineers in the TO. These same principles apply to developing the engineer architecture at all echelons. (See Appendix A for types of engineer organizations.)

ORGANIZATIONAL PRINCIPLES

Through the tactical decision-making process and the engineer estimate, engineer commanders properly allocate forces to accomplish the engineer mission. The following principles provide a framework for commanders and staff officers to follow:

Task-Organize Engineer Forces to Requirements

Mission requirements drive the size and composition of engineer units. A mix of different units often is necessary to achieve the proper balance of capabilities. This mix can change as the operation progresses.

Give Priority to the Main Effort

The battlefield never has enough engineers to handle all tasks. They are not spread evenly but are concentrated to ensure the main effort's success. Because of this, risk can occur elsewhere. Engineers focus on the mission and not on habitually supporting a particular organization.

Integrate Engineers with Maneuver and Fire

The scheme of maneuver governs the engineer plan. Fire, maneuver, and mobility/countermobility form a triad. Neither fire nor maneuver is truly effective if the combat formation cannot move at will and deny battlefield maneuver to the enemy. Engineers operate well forward in the CZ to integrate mobility/countermobility into the triad.

Ensure That Current Engineer Operations Promote Future Force Operations

Engineers must begin their work early to be done on time. They have to anticipate future missions and reposition their unit, if necessary, while accomplishing the current mission. Engineers not only have to accomplish the immediate mission but their services must also fit into the commander's long-term intent.

Do Not Hold Engineers in Reserve

Engineers organic to maneuver forces do not stay with those forces when they are held out of the fight. Engineers remain out of action only long enough to refit after a major action. Then they are committed in support of forward forces. Plans must ensure timely return before the parent maneuver force's commitment to combat to ensure adequate integration and preparation. (Engineer forces can be positioned to support reserve or counterattack forces or positioned in a follow-and-support role.)

Build a Logistically Sustainable Force

Resources are always limited. Material, transportation assets, and time restrict the engineer's ability to execute plans. Engineer-unit sustainment and the supporting logistics structure must be planned in detail. Logistics limitations may restrict the size of the usable engineer force.

Maintain Effective C2

Timely and accurate information is power. C2 facilities must function vertically and horizontally. Facilities must monitor and track combat operations and send accurate reports to the right person at the right time.

Use All Local Resources

Engineer resources belonging to local governments, other services, and allied forces are present in every theater. At the tactical level, improvising may be necessary to convert on-site materials and equipment to military use. At higher levels, HN resources are well suited for general-engineering support, especially in the rear areas. Local resources augment available engineers, releasing more engineer units forward to the CZ.

ORGANIZATION OF THE THEATER

Engineers operate throughout the theater. The numbers, types, and locations of engineer units in the organization reflect their intended missions. Combat-engineer units have missions in the CZ (division and corps areas). Combat battalions (heavy) have missions primarily in the COMMZ, corps's and division's rear areas, and sometimes in forward brigade areas. Separate engineer companies and teams have missions wherever their expertise is needed.

Engineers are always required in a TO. This force must be carefully tailored to its mission, well planned and well rehearsed. Contingency operations need a greater proportion of engineers than normal to support the force.

COMMUNICATIONS ZONE

The COMMZ provides the sustaining base for combat operations at the operational and tactical levels. The organization of engineer units in the COMMZ initially depends on the extent of TO construction (for base facilities and transportation networks) needed beyond those already available to support the operational commander. As the theater matures, the engineer organization changes, reflecting the need to maintain and repair those facilities and networks.

Requests for engineer missions pass from an area support group (ASG) to the engineer group in GS or

from a TAACOM to the engineer brigade in GS. The engineer group or brigade assigns missions based on the priorities that the ASCC directs. Engineer units in the COMMZ execute the missions under control of the ENCOM structure. Only in an emergency might an ASG commander have OPCON of engineer units in his area to fight the rear-area threat.

Tactical Operations

The rear area is not safe from combat. Therefore, operational-level engineer units develop protective shelters and camouflage measures for support units and combat forces in the rear. The engineer units provide mobility/countermobility support to rear-area forces committed to destroying enemy insertions. They also assist in ADC.

Construction

New construction, maintenance, and repair work in the COMMZ sustain combat operations forward. The engineer brigades and groups plan, coordinate, and supervise this work. It includes roads, railways, pipelines, bridges, airfields, ports, buildings, utilities, and enemy prisoner of war (EPW) camps and installations.

Engineer combat battalions, heavy, have a variety of equipment, tools, and skills to do all types of construction. Some types, such as asphalt paving, require help from separate engineer companies and teams. Construction-support companies operate and maintain specialized construction equipment to augment the combat battalions, heavy.

Dump-truck companies provide additional haul assets. Pipeline-construction support companies provide technical personnel and special equipment to support pipeline construction and related facilities. Port-construction companies provide technical personnel and special equipment for constructing and restoring ports; logistics-over-the-shore (LOTS) facilities; inland waterway facilities; and petroleum, oils, and lubricants (POL) marine terminals.

Topographic Engineering

The theater topographic battalion HQ is located in the COMMZ, and will generally fall under the ENCOM if the ENCOM is in-theater. With the topographic planning-and-control team at the theater HQ, the topographic battalion coordinates with the HN and the Defense Mapping Agency (DMA) to fulfill theater requirements. The GS topographic company—

- Supports noncorps units at the theater level.
- Assists the DS companies in the corps's areas.
- Is normally located with the battalion HQ, but it may send elements to other locations, such as the echelons above corps (EAC) intelligence center.

Real-Property Maintenance Activities

The ASCC has overall responsibility for RPMA. The TAACOM, through its ASGs, normally provides the needed RPMA support. Principal RPMA functions in a TO include operation, repair, and maintenance of facilities and utilities; fire prevention and protection; and refuse collection and disposal. The logistics organization's RPMA requirements that exceed their capabilities are forwarded to the

supporting engineer group for execution according to the theater priorities. The TAACOM provides technical RPMA guidance to the ASGs. ASGs provide RPMA support to all Army facilities in their AOs, to include leased facilities, unless host-nation support (HNS) is available for leased facilities.

Configuring engineer units to support the ASGs is based on the expected RPMA work load. They are tailored to the specific ASG that they will be supporting to accomplish RPMA missions.

RPMA may be administered on a centralized or decentralized basis. If decentralized, the TAACOM, through its ASGs, uses supporting engineer teams, USACE contracted RPMA engineering service, or HNS to accomplish it. ASGs have small cells to receive, prioritize, and coordinate engineer-support requirements. They assess work loads, sequence critical requirements, and request assistance from the engineer group in GS.

Many specialized engineer teams can be tailored to the needs of a particular ASG and support it under an engineer C2 HQ team. Except for the specialized teams assigned to the ASG, the engineer group has control of all engineer units in its assigned area. The ENCOM can also administer RPMA on a centralized basis. FM 5-116 contains more details on engineer operations in support of RPMA.

CORPS'S AREA

The corps generally fights at the tactical level of war; although, it may fight at the operational level during contingency operations. It has an engineer brigade assigned to it. The numbers and types of engineer units assigned to the brigade depend primarily on the mission of the corps, the numbers and types of their divisions and separate brigades, the enemy facing them, and the environment. Normally, each committed division of the corps will have with it elements of an engineer group from the corps engineer brigade. See FM 5-100-15 for more information on corps engineer operations.

TACTICAL OPERATIONS

Engineers have combat missions in all parts of the corps's area. Corps units operating in the forward part reinforce the division engineers. Many of the tasks performed by corps battalions in the corps's rear area are also done in the forward area while supporting the divisions.

In the corps's area, some of the missions are to provide guidance to units on protective shelters and camouflage measures. The major engineer commitment, however, is to keep the LOCs and tactical march routes open to sustain the committed forces, shift other forces, and implement corps-directed attacks. This requires continuous damage repair caused by enemy action, heavy traffic, and the weather.

Corps combat-engineer battalions perform most of these tasks. Combat-support equipment companies augment the combat battalions with equipment to move earth and maintain horizontal surfaces such as roads and airstrips. The combat battalions also assemble tactical bridges provided by panel-bridge companies or allocated from theater stocks for use on LOC and other routes. Medium-girder-bridge (MGB) companies erect their own tactical bridges.

The engineer brigade also has float-bridge assets for river-crossing operations. Ribbon-bridge (RB) companies transport, assemble, and operate ribbon rafts and bridges during river-crossing operations. Other float-bridge companies provide different types of bridging for longer-term use at the crossing sites.

Combat battalions also assemble these float bridges.

The light corps combat battalions and the light-equipment companies reinforce the light division engineers, particularly during their initial deployment. The airborne corps battalion can parachute into an operational area and construct an assault airstrip. The light equipment company augments light forces with additional earth-moving equipment.

The separate brigades and the ACRs have an organic engineer company, which is usually not sufficient to handle all of the engineer tasks required when they are committed to combat. The corps engineer brigade reinforces these organizations and additional combat battalions and separate companies as determined by the mission and situation.

CONSTRUCTION

Construction activities occur throughout the theater and are not limited to the COMMZ. Within the corps's area, operational construction requirements, such as forward log bases, heliport,s and main supply routes (MSRs), are needed to ensure the continuity of support for combat operations. These activities are in addition to the corps-generated construction requirements (bed down, logistic bases, rehearsal ranges, and so forth) that keep corps construction assets fully engaged. The nature of corps operations limits construction to the essential facilities needed to sustain the current fight or to support near-term major operations.

To facilitate the forward focus of these corps engineer assets and to accomplish the myriad of tasks beyond the corps engineer's capabilities, operational-level engineers work within the corps's area. Control measures such as engineer work lines (EWLs) delineate areas of responsibility and are positioned as far forward as practical. EWLs are, therefore, independent of other boundary control measures, such as the corps's rear boundary, allowing operational-level engineers to concentrate on forward efforts critical to the close fight. Finally, the theater augments all its corps by assuming responsibility for specific support on a task basis forward to the EWL, again releasing corps construction units to engage in activities far forward and of immediate concern to the corps commander.

TOPOGRAPHIC ENGINEERING

A DS topographic company of the theater topographic battalion provides all forms of support for the corps. It is in the corps's rear area and provides a terrain-analysis team for the corps's CP.

REAL-PROPERTY MAINTENANCE

Utility teams supporting the corps support command (COSCOM) provide RPMA support in the corps's area. Additional support may be available through HNS, or the engineer brigade may assist with its combat battalions (heavy). The ENCOM provides additional support and technical guidance as necessary.

DIVISION AREA

The engineer infrastructure at the higher echelons makes it possible to commit and sustain divisions in combat. Divisions perform major tactical missions and can conduct sustained battles and engagements. The engineer forces organic to each division are tailored specifically to support that division. The corps engineer brigade provides additional engineer units based on the division's specific mission and tactical situation.

TACTICAL OPERATIONS

The division combat-engineer battalion is an element of the close combat fight. Corps combat battalions also participate in the division's close fight. Corps usually places at least one battalion in a command relationship to the division for this purpose. It fights well forward in the brigade's areas along with the division companies. Corps and division engineer elements often mix and cross-attach to enhance the relative strengths of each. The HQ of the normally associated corps engineer battalion often commands all engineers supporting a main effort brigade.

Each committed brigade normally needs the equivalent of an engineer battalion or one engineer company per battalion TF. This level of engineer support is adjusted based on the mission, enemy, terrain, troops, and time available (METT-T) analysis.

Additional corps battalions operate in the division on an area or task basis. Separate engineer companies, especially bridge companies, operate in the division as needed. When the division has the priority and need for a large contingent of corps engineers, it will often have an entire engineer group with it. When allocated to a division, the group HQ controls all engineer operations in the division's rear area. It allocates and controls engineer forces and resources for selected tasks in the maneuver brigade's areas. It may be a planning-and-control HQ for engineer tasks affecting the entire division, such as a divisional assault river crossing or a deliberate breach.

TOPOGRAPHIC ENGINEERING

The DS topographic company in the corps's area also provides a terrain-analysis team to the division. The team locates at the division's main HQ and works with the division's Assistant Chief of Staff, G2 (Intelligence) (G2) with input from the division engineer. See FM 5-105 for more information.

CHAPTER 3

Force Projection

CHARACTERISTICS

Force projection is the ability to alert, mobilize, deploy, and operate rapidly anywhere in the world. It is a key element of power projection, which is a nation's ability to apply all or some of its national power elements to act in a crisis, contribute to deterrence, and enhance regional stability. The engineer plays an important role in the smooth succession of force projection.

The most important characteristic of force projection is synchronizing all assets at all levels of war and projecting forces rapidly in response to a crisis. Force-projection operations usually begin as contingency operations, involving imminent or actual involvement during war, or as conflict on a regional scale. A commander may be able to achieve theater aims faster by committing a smaller forward-presence force than by waiting for a larger, but less timely, response option. In this case, US forces could be opposed; however, force projection may occur unopposed. Unopposed operations could afford forces time to continue to build combat power, train, and acclimate after they arrive in theater. The engineer will conduct force projection as part of the overall joint- and, possibly, multinational-force operation. Engineer-support efforts require close coordination with joint and coalition military engineer forces, along with other agencies to meet force-projection requirements.

PERSPECTIVE:

> Early planning for the buildup and operations in Vietnam had little more to go on than tentative indications of the number of maneuver battalions that might be deployed. There was no generally accepted tactical concept, campaign plan, or scheme of logistics support upon which effective engineer planning could be based. In fact, subsequent difficulties tended to confirm that there had been a remarkable lack of appreciation of the amount of engineer effort required to support deployments of the scale being considered in 1965. The myriad factors to be considered in planning for any one of the hundreds of engineer tasks to be performed made the planning process much more complex than most commanders, who were not engineers, realized. The essence of engineer planning for force-projection operations involves a series of evaluations, improvisations, and compromises which, when given proper attention, produce comprehensive and effective engineer support.

CONSIDERATIONS

Force-projection operations will challenge all leaders. Early critical decisions, made under uncertain circumstances, will be required at all levels. These decisions can greatly affect future conditions for successful mission accomplishment. Unit mobilization and deployment can occur at the same time, or sequentially, and are based on force requirements and strategic aims. When an engineer unit deploys, it will do all that is necessary to meet the demands of the overall mission

Operational design and unit execution must be capable of overcoming any unforeseen obstacles. In most force-projection scenarios, combat engineers will be unable to cope with the requirements for general engineering, real estate support, and related technical services required to develop and maintain the operational support base. However, they can provide some of the initial C2 and planning required until additional engineer support becomes available. US Army engineers respond to these operational-level engineering requirements with a mix of military and contractor capabilities, integrating tailored organizations and elements from the USACE. FM 100-5 describes several key considerations that apply to force-projection operations. The following are engineer-mission capabilities that may arise during the force-projection process:

LETHALITY FOR THE DEPLOYING FORCE

An important strategic consideration for planning contingency operations that involve the potential for combat is to introduce credible, lethal forces early. The early entry force must possess the required lethality to accomplish the mission and protect the force the moment it arrives in theater. Engineers may contribute to the lethality of the early combat force by placing minefields and other obstacles. They protect lodgments by constructing secure C2 nodes, logistics bases, and other needed fortifications and survivability positions. The lethality of combat forces securing operational objectives can be enhanced through engineer mobility and countermobility operations.

ANTICIPATION AND INTELLIGENCE

Force-projection anticipation is the expectation of being alerted and deployed. Introducing US forces to an area, rapidly, requires accurate, detailed, timely, and continuous intelligence. If units have been assigned a region of focus in peacetime, planning can occur before alert and deployment. Commanders/operators need direct access to engineer assessments of the theater infrastructure for developing COAs and evaluating the infrastructure. Engineers provide topographic terrain products of likely contingency areas to support the IPB process. They will also assess the available infrastructure for possible general-engineering requirements, which include airfields, MSRs, ports, utilities, and logistics facilities. Engineers must anticipate requirements for construction, construction standards, and critical resources to support deployed forces. Other intelligence and preparation might be learning the threat engineer's capabilities and preparing for them accordingly.

FORCE TAILORING AND TEAMWORK

Force tailoring is the process of determining the right mix and sequence of the following:

- Combat engineers.
- Construction engineers.
- Contractors.
- USACE elements.
- Topographic engineers. Forces on quick alert may have little opportunity to tailor forces. Follow-on forces can be tailored to meet the specific concerns of the long-term mission. Proper planning should give the operational commander the resources and dispositions to deal with anything that might jeopardize the mission of protecting the force. Commanders consider METT-T, strategic lift, pre-positioned assets, civilian-contractor support, and HNS when tailoring forces. Deploying units must be very flexible and versatile, valuing early and continuous planning and teamwork.

BATTLE COMMAND

During force projection, engineer commanders must develop an appreciation for the extent that his force will conduct a versatile role during war and contingency operations. He must quickly visualize the battlefield environment and articulate a clear intent. His intent and other guidance will provide the impetus for staff planning and set the conditions for anticipating engineer requirements.

Commanders must deal with deployment, entry, and combat, while being able to adjust to the evolving conditions of each. Deployment can cause the physical separation of units in space and time and the separation of the unit from the next higher HQ. Units may be placed under unfamiliar organizations. Simplicity and the ability to adapt and adjust are key considerations. Engineers are very involved with deployment, entry, and combat. They must support

- Deployment while deploying.
- Lodgments with construction and leasing.
- Maneuver operations with combat engineering. To do this, engineers execute missions at the small-unit level while engineer command echelons are separated in time and space. Engineer commanders at all levels must exhibit an ability to recognize where and when they need to be to influence the situation. Moreover, they must demonstrate confidence in their subordinates and stimulate a level of initiative and motivation that accomplishes the mission with very little supervision.

LOGISTICS

Like the initial entry forces in TOs, logistics must be tailorable and flexible. The availability of ports, airfields, roads (infrastructure), and other assets will affect the sequencing of units and the tempo of entry operations as well as the overall logistics planning. Engineers support force-projection logistics operations by leasing or constructing forward support bases, intermediate staging bases, and lodgments; improving aerial ports of debarkation (APODs) and seaports of debarkation (SPODs); and providing engineer support for LOTS operations. Engineers must work with logistic planners to synchronize the

flow of engineer logistics with the flow of engineer units into the TO. This includes working closely with HN and contracted logistics support.

TRAINING AND MULTIFORCE OPERATIONS

Demanding and relevant training helps commanders focus on missions and conditions expected during force projection. Units continue to train to standard and to rehearse following arrival in theater and throughout the conduct of operations as time, enemy, and other conditions permit. The following types of missions continually prepare engineers for future force-projection operations during war and contingency operations:

- Training at combat-training centers (CTCs).
- Deployment overseas in peacetime.
- Training while conducting nation assistance.
- Disaster relief.
- Peacekeeping.
- Drug eradication.
- Humanitarian assistance missions around the globe.

MEDIA IMPACT

Emerging information communication technologies, the evolving global-information environment, and the media's ability to provide live coverage from anywhere in the world to everywhere throughout the world bridge the gap between the tactical, operational, and strategic levels. Media coverage of Army operations can influence public opinion; political decisions; and the direction, range, and duration of operations.

Engineer operations, especially those executed in support of contingency operations, are likely to attract significant media coverage. Engineers at all levels—

- Must be prepared to operate in a media-intense environment.
- Need to understand that the Army has a vital interest in facilitating media coverage and communicating the Army's perspective.
- Must be prepared to support open and independent reporting and access to units as early and as far forward as possible.
- Should be trained to interact with media representatives and provide complete, accurate, and timely information, confidently.
- Must know that public-affairs support is available. Effectively operating in the global information environment increases understanding and confidence; enhances morale and discipline; and results in trust, respect, and esteem for soldiers and the Army. In the emerging information environment, it is a critical element of mission success.

POSTCONFLICT

Issues related to the strategic end state, postconflict activities, and transition to peace are considered throughout force-projection operational planning and execution. Engineers play a significant role in conducting postconflict activities.

OPERATION PHASES

Force-projection operations follow a sequence, even though the phases often overlap in space and time. The phases are—

- Predeployment.
- Mobilization.
- Deployment.
- Entry.
- Operations.
- War termination and postconflict.
- Redeployment and reconstitution.
- Demobilization. Force-projection operations seldom begin with a clear idea of purpose, and they do not end when units arrive in theater.

PREDEPLOYMENT PHASE

Force-projection operations start with crisis-action planning and predeployment activities. When engineers receive a mission, they determine what military conditions they need for success, sequence activities to achieve those conditions, and apply resources accordingly. The objective of this phase is to select the proper force and derive the correct operational concepts for the next phases of the operation. Decisions made in the predeployment phase determine the engineer's capabilities for the entire force-projection operation.

Necessary force tailoring starts in this phase; for example, leading combat engineers are selected for forcible entry to aid in lodgments and meet conditions for the next phases. Pre-positioning engineer materials and equipment in possible theater locations may reduce transportation requirements for engineer forces. HN engineer's capabilities must be considered. Timely topographical engineer support is critical to determine where to conduct operations and identify HN infrastructures, which may be available to sustain operations. Possible real estate acquisition from the HN is considered at this time.

MOBILIZATION PHASE

Mobilization is the process by which the armed forces reach a state of enhanced readiness in preparing for war or other national emergencies. It includes activating all or part of the reserve components, as well as personnel, supplies, and material, before deployment.

Approximately three-fourths of the total engineer force structure is in the US Army Reserves and Army National Guard. A large force of the projection engineer capability also exists in the USACE divisions

and districts throughout the continental United States (CONUS) and overseas. Because of this, force-projection operations may require mobilization of the reserve-component engineer forces and USACE personnel. Activated engineer forces may include corps engineer groups, battalions, and companies; USACE agencies; elements of the ENCOM; other theater engineer units; and specialized engineer teams and personnel. Activated reserve-component engineer units and USACE agencies maintain a high state of personnel, equipment, and training readiness. These units and agencies continually demonstrate their mobilization proficiency during day-to-day operations, annual-training deployments throughout CONUS and overseas, state emergency duty, and other support to national emergencies.

DEPLOYMENT PHASE

Deploying engineers depend on the availability of METT-T, accounting for any changes in the mission or enemy forces that have occurred. Deployment includes the synchronized deployment of engineers, equipment, and critical materials. Sea-lift and airlift assets will greatly affect the actual deployment of engineers. Upon deployment, tasks include acquiring, constructing, or upgrading deployment facilities; marking and maintaining deployment routes; and assisting in the deployment process.

ENTRY PHASE

The main focus of the entry phase is to build up combat power as quickly as possible while simultaneously preparing for or conducting combat operations. Entry may be in DS of HN or forward-presence forces. In some instances, conditions may dictate that operations be conducted in the absence of either. Entry may be opposed or unopposed. Commanders sequence combat, CS, and CSS units into the contingency area in a manner that enables them to gain and sustain the initiative and protect the force. METT-T will greatly influence how the engineers task-organize to meet the anticipated needs for the initial-entry operation.

Engineers are well equipped to handle a myriad of tasks to support early-entry operations; it may entail seizing and improving airfields, lodgments, and infrastructures. While conducting combat operations, engineers repair or improve runways, airports, seaports, and roads, and they exploit and develop existing infrastructures. Mobility/survivability (M/S) considerations must be made to ensure that the initial-entry force can move freely and to provide a level of survivability that protects the force.

PERSPECTIVE:

In the spring of 1965, American air, ground, and naval forces deployed to the Caribbean nation of the Dominican Republic to restore order in the violence-plagued nation. Ultimately, a multinational force was involved in efforts to stabilize the country and end the fighting between warring factions. The basic difficulty stemmed from the fact that the US was officially neutral, and its forces could not fire unless fired on by hostile factions. The primary objectives were to contain opposing forces and separate the two major warring Dominican factions.

The initial engineer effort, for both Marine and Army engineers, was to establish the force ashore. Soon, force protection became the major task. Marine engineers used more than 300,000 sandbags and 3,000 rolls of concertina for defensive emplacements and outposts.

Army engineers used 36,000 sandbags, 1,500 rolls of concertina, field-expedient chevaux-de-frise of timber and wire, and 300 earth-filled 55-gallon drums for Army force protection. This ultimately included rewiring streetlights to illuminate outposts that were under constant harassing attacks.

Engineers then turned to LOC construction to ensure logistics support to the joint task force. Road movement was complicated by countless burned-out vehicles and destroyed barricades. LOC construction included converting a small sugar port to a logistics port for landing ship tanks (LSTs). Navy and Army engineers built a floating POL discharge point to provide POL for the peacekeepers and to sustain power generation for the country. Army engineers even reopened the local incinerator and organized indigenous work parties to clean up the trash in their section as a health and welfare measure. In addition, engineers had provided more than 1 million gallons of water by the end of the first month of operations.

OPERATIONS PHASE

Engineers play a significant role during this phase, executing the numerous tasks required during decisive combat operations. Some of the tasks are—

- Conducting mobility, countermobility, and survivability (M/CM/S) operations as part of combined-arms teams engaging the enemy simultaneously throughout the depth and space of the AO.
- Constructing forward operating bases, forward landing strips, combat trails, and supply routes.
- Protecting the arriving force with engineer countermobility and survivability operations.
- Providing terrain analysis and terrain management.
- Assisting in reception-, staging-, and onward-movement operations with general engineering. Assistance includes erecting portable structures and constructing aircraft bed-down facilities, training facilities, EPW camps, and refugee facilities.
- Conducting engineer reconnaissance operations to locate and analyze enemy obstacles and fortifications, road and trail networks, logistics facilities, and construction materials and equipment.
- Facilitating joint and special operations with other forces.
- Conducting other needed force-projection operational-level engineer missions, such as acquiring real estate, contracting for HN construction, drilling wells, fighting fires, constructing pipelines, cleaning up hazardous waste, and supplying prime power. Other tasks engineers may perform include—
- Constructing defensive positions and logistics bases.
- Conducting river crossings.
- Providing force protection and survivability.
- Conducting camouflage and deception operations.
- Breaching obstacles, widening assault lanes, clearing minefields and, on a limited basis, unexploded ordnance (UXO).
- Marking supply routes.
- Conducting equipment and munitions denial operations.

- Producing and distributing nonstandard, topographic products.

WAR-TERMINATION AND POSTCONFLICT PHASE

Successful combat operations are designed to end a war quickly. When hostilities cease or a truce occurs, deployed forces transition to a period of postconflict. This transition can occur even if combat operations are still underway in other parts of the theater.

Engineers, when required, are suited to—

- Help restore order.
- Establish the HN infrastructure.
- Prepare forces for redeployment.
- Assist in demining.
- Clear UXOs.
- Destroy enemy materiel and weapons.
- Remain in theater. Engineers conduct various postconflict missions, such as constructing camps for displaced personnel, constructing EPW camps, developing potable-water supplies, restoring utilities, rebuilding roads and bridges, and marking/clearing minefields and, on a limited basis, UXO.

REDEPLOYMENT AND RECONSTITUTION PHASE

The objective in this phase is to quickly redeploy assets that are no longer needed. Postconflict activities directly impact the redeployment flow. Along with this, the force must be reconstituted for other missions. At this time, CS and CSS elements often remain in theater to support forward-presence peacekeeping or other nation-assistance efforts. Engineers focus on constructing or repairing redeployment facilities and staging areas, to include washracks and equipment holding and sterile customs-inspection facilities. Engineers also may conduct—

- Force protection.
- Sea-port and airport facilities maintenance.
- Battlefield cleanup.
- Supply-route and facility maintenance.
- Other needed general engineering.
- Construction of hazardous-waste containment facilities.

DEMOBILIZATION PHASE

Demobilization is the process by which units, individuals, and materials transfer from the active to reserve status. Demobilizing logistics requires resources such as supplies, materials, and support activities. Engineers may be involved with the handling and storing of and accounting for demobilized

equipment and supplies. Typical missions include constructing, upgrading, or removing logistics facilities; repairing installation routes; terminating leases and settling real estate claims; and cleaning up damages.

CHAPTER 4

Joint, Multinational, and Interagency Engineer Organizations and Capabilities

PERSPECTIVE:

The ground assault plan into Iraq by the 7th US Corps units called for the 1st United Kingdom (UK) Armored Division to follow and pass through the 1st US Infantry Division's (mechanized) breach of initial Iraqi defenses during the night. This operation equated to a deliberate river-crossing operation and its planning requirements.

As plans were developed to pass the British forces through the 1st Infantry Division, a crossing force HQ was formed that included the 176th US Engineer Group, British liaison officers (LOs), and the 1st US Infantry Division's assistant division commander for maneuver (ADC-M) as the crossing force's commander. Most planning and coordination was done face to face or through the British LOs, due to the incompatibility of communications equipment between the US and British forces.

The crossing force HQ orchestrated several terrain walks and drive-through rehearsals with the 1st UK Division. This series of rehearsals began with sand-table exercises with key British leaders. Scaled-down obstacle mock-ups were used showing lanes, marking signs, and traffic-control points. Force-passage time lines were determined along with passage-control measures. Terrain walks with the British leadership followed at a training obstacle site constructed for the 1st Infantry Division (mechanized). The site was about 10 kilometers deep, contained eight breach lanes, and represented the worst-case obstacle that could be found in Iraq. All British vehicle drivers, riding in 25 percent of the British vehicle fleet, participated in a drive-through rehearsal at the training obstacle site. This drive through was conducted in daylight; all lane-marking signs were in place, and traffic-control points were manned. The 1st UK Division commander was impressed with the results and ordered a full division rehearsal through the training obstacle site with all combat and support forces. This rehearsal took 36 hours to complete, including a nighttime crossing. One British brigade got lost during the rehearsal, missing the breach location. Some soldiers were killed in accidents during the crossing. The British leadership believed that this was a very serious operation and took all of this into account as wartime preparation. Following the 1st UK Armored Division rehearsal, after-action reviews were held with the crossing force HQ, refining the procedures for the actual passage.

OVERVIEW

Army engineer commanders and staffs operate jointly with Air Force, Navy, and Marine Corps engineers during force-projection operations. Also, Army engineers operate with multinational engineers, civilian contractors, US governmental agencies, nongovernmental organizations (NGOs), private voluntary organizations (PVOs), and United Nations (UN) agencies. Army engineers must fully understand joint, multinational, and interagency engineer capabilities to integrate them into operational and tactical planning as well as provide engineer support to joint, multinational, and interagency HQs. This chapter provides a brief description of the types of joint, multinational, and interagency engineer units and their capabilities and interoperability considerations.

During all force-projection operations, the Army engineer ensures that adequate Army communications, logistics, topographic, and LO support are provided for supporting the joint, multinational, and interagency engineers. Periodic meetings assist in blending these engineers towards accomplishing the numerous engineer missions required during force-projection operations.

US AIR FORCE (USAF) ENGINEER SUPPORT

The USAF is challenged by a variety of threats throughout the world. Therefore, it must be prepared¯

- To fight battles of great scope, range, and intensity.
- To counter large modern forces, as well as light forces, insurgents, and sophisticated terrorist groups, wherever and whenever they threaten US interests. To meet this wide range of threats, the worldwide air-base network used by its forces must be capable of supporting the projection of air power.

  Combat air operations depend on adequately developed and supported bases. Bases must have adequate facilities and civil-engineering resources to launch and recover mission aircraft, support high sortie generation rates, provide essential CS functions, and assist in defending against an enemy attack.

CIVIL-ENGINEERING MISSION

The Air Force combat engineer's role is to ensure that the engineering-related aspects of air-base operations are responsive and effective. The following are the basic wartime missions of Air Force engineers:

- Repairing war damage (includes rapid runway repair [RRR], facility repair, and utility repair) on an emergency basis.
- Bed down of Air Force units and weapons systems.
- Operating and maintaining Air Force facilities and installations.
- Crash rescue and fire suppression.
- Construction management.
- Supplying materiel and equipment to perform its engineering mission. To accomplish these

missions, Air Force engineers are organized into three basic types of units, with complimentary wartime missions: rapid, engineer-deployable, heavy, operational repair squadron (RED HORSE) engineer units, Prime base engineer emergency force (BEEF) units, and Prime readiness in base support (RIBS) units. An engineering and services (E&S) force module combines Prime BEEF and Prime RIBS capabilities to support a flying squadron.

RED HORSE PROGRAM

The RED HORSE was formed specifically to meet wartime needs. Its composition is based on wartime requirements, and it is not assigned to an air base to perform peacetime operations and maintenance taskings. Its primary mission in peacetime is to train for wartime, and the squadrons represent the strongest combat-engineering capabilities in the Air Force. As the lead joint-engineer resource in any force-projection situation, a RED HORSE unit is the most capable Air Force engineering unit when it comes to the initial wartime requirements affecting the launch, recovery, and operation of Air Force combat aircraft. It is the engineer unit that the theater or joint task force (JTF) commander uses when incoming force flow is disrupted, resupply is interrupted, or launch-and-recovery activities at critical locations are stopped due to major airfield damage.

RED HORSE units are packaged to be available early in the time-phased deployment data flow and dedicated to up-front engineer missions. They are assigned to employment locations that are critical to the success of the air war. Dividing responsibilities between Air Force engineering assets (RED HORSE, Prime BEEF, Prime RIBS) is not attempted. RED HORSE units could perform all the engineering missions of the civil-engineering units except for crash rescue and major fire suppression. If Prime BEEF forces are employed at a location, that does not exclude employing the RED HORSE units.

Civil-engineering RED HORSE units are wartime structured to provide a heavier engineering capability than the civil-engineering base Prime BEEF and Prime RIBS units. RED HORSE units—

- Have a regional responsibility.
- Are not tied to a specific weapons system.
- Are not responsible for base operations and maintenance.
- Are mobile, rapidly deployable, and largely self-sufficient for limited periods of time.
- Perform the wartime tasks of major force bed down, heavy damage repair, bare-base development, and heavy engineering operations. RED HORSE units are theater Air Force assets with a regional responsibility; they report through theater or regional command channels. C2 RED HORSE units remain within numbered Air Force channels, or at a higher level, if a numbered Air Force is not present (that is, not under the Air Force forces (AFFOR) commander of a JTF). A joint-contingency, wartime, construction-management organization can also task RED HORSE units through the numbered Air Force for construction support. If two or more RED HORSE units are in a region, they and an Air Force civil-engineering group will be formed, with the numbered Air Force staff engineer serving as the group commander.

  Strategic heavy lift vehicles, heavy equipment, and RRR sets capable of supporting full RED HORSE units are pre-positioned in projected TOs to eliminate delays in receiving. Besides theater pre-positioned sets, RED HORSE units maintain home mobility sets of the similar equipment that are easily deployed and maintained. RED HORSE units form three deployable RED HORSE (RH)

echelons, with vehicle and equipment sets at strategic locations. They are maintained in a ready-to-go condition.

The standard engineering capabilities that RED HORSE units provide include—

- Airfield lighting.
- Concrete operations.
- Explosive-demolition operations.
- Aircraft-arresting systems.
- Materiel testing.
- Quarry operations.
- RRR.
- Revetment construction.
- Water-well drilling.
- Mobile facility-asset siting, erection, and installation.
- Fuel systems.
- Facility hardening.
- Expedient pavement expansion.
- Utility system repair.
- Force bed down.
- Heavy earthwork.
- Road construction.
- Power generation.
- Restoring chemically protected facilities.
- Engineering design.
- Base-denial operations using fire, explosives, component removal, equipment sabotage, and mechanical destruction.
- Disaster relief and preparedness.
- Defensive operations.
- C2 over full-squadron deployment to one location, full-squadron deployment with phased arrival to one location, squadron deployment to multiple locations (split-unit), in-transit operations during deployment, and work party and convoy operations. RED HORSE units accomplish major airfield construction-and-repair work in forward locations, requiring an organic logistics capability to include vehicle maintenance, food service, supplies, and logistics plans. A 60-day war readiness spares kit (WRSK) keeps these units operational until normal supply channels open up.

RH-1

RH-1 consists of 16 people that can deploy within 12 hours on a C-141. The team—

- Performs advanced airfield surveys, to include evaluating airfield pavements, water supplies, utility systems, and existing facilities.

- Prepares a bed-down plan for the orderly establishment of a base of operators at a force-projection location.
- Compiles facility and material requirements necessary to accomplish the force bed-down plan.
- Accomplishes the site layout for later RH-2 force bed down. Advance deployment of the RH-1 is critical to RED HORSE employment. This element, tied to the appropriate theater air-component commander, would deploy with the HQ and prepare to receive follow-on RED HORSE elements and the advance plans for project execution.

RH-2

The RH-2 consists of 93 people, with heavy equipment, who can deploy within 48 hours. The team—

- Performs land clearing, site stabilization, area drainage earthwork.
- Erects relocatable structures essential to force bed down at an undeveloped location.
- Performs RRR using organic equipment and repair materials (AM2 mat, crushed stone, and so forth) that are pre-positioned or supplied by the support HQ.
- Repairs bomb-damaged facilities and systems.
- Installs, expands, and repairs essential utility systems.
- Provides initial civil-engineering support to include drilling and developing water wells for deploying forces.

RH-3

The RH-3 consists of 295 people, with heavy equipment, who can deploy within 6 days. The team—

- Accomplishes heavy repair of bomb-damaged facilities and utility systems.
- Erects temporary relocatable facility substitutes.
- Installs or expands essential utility systems, including airfield lighting, to support force bed down.
- Operates mineral-product plants (batch, crusher, block), if required and when plant equipment is supplied from contingency or host stocks.
- Performs explosive demolition operations, as required.
- Performs RRR using echelon organic equipment.
- Is able to repair two large and three small bomb craters in a 4-hour period.

PRIME BEEF PROGRAM

All Prime BEEF forces are CS forces. They are generally configured as squadrons and teams. They provide CS to the air combat forces that are, or may become, a part of a theater, command, or TF formed for combat operations. These base civil-engineering (BCE) units are organic at essentially all major CONUS and overseas Air Force bases. This capability is integrated into the peacetime force structure, totally, and gives the operational commander the flexibility to employ weapons systems without depending on others.

When flying squadrons go to war, organic Prime BEEF CS forces that can perform engineering wartime

tasks necessary for sortie generation will deploy with the squadrons. Specific Prime BEEF CS units will be linked to specific flying units and will concentrate primarily on supporting aircraft weapons systems and combat operations. There are two basic Prime BEEF mobile force classifications: large-scale CS squadrons and small specialty CS teams. Prime BEEF CS units—

- Have no organic heavy equipment; they only have tool boxes and small team kits (power tools and so forth).
- Require base-operating support.
- Deploy, usually, in 50- or 100-person team increments.

Large-Scale CS Squadrons

These squadrons provide basic skills to establish BCE operations or to accomplish the most critical wartime tasks where additional assistance is required or where none exists. Eight types of large-scale CS squadrons are available in four separate and distinct sizes: 50, 100, 150, and 200 persons. Combinations of these eight types are used to support theater requirements. The squadrons—

- Are active duty, Air National Guard (ANG), or Air Force Reserve.
- Can deploy on 22 to 28 hours notice to support aircraft operations at main operating bases (MOBs), collocated operating bases (COBs), standby bases (SBs), forward operating locations (FOLs), APODs, and bare bases (BBs).
- Can fully support AM2 matting, fiberglass matting, and concrete slab RRR methods.
- Can support a bed-down population of 2,200 to 2,500 personnel.

Small Specialty CS Teams

Small specialty CS teams are comprised of certain numbers and personnel with certain skills to fill known requirements: fire fighting, construction management, and staff augmentation. Nine types of teams are available that range in size from 3 to 48 persons from all components. The size and composition of all Prime BEEF mobile teams are based on METT-T.

PRIME RIBS PROGRAM

Prime RIBS units are worldwide combat morale, welfare, recreation, and services (MWRS) forces organized and trained for wartime support. The Prime RIBS program organizes forces that can deploy on a 22 to 28 hours notice to support global or major regional conflict operations on MOBs, COBs, FOLs, APODs/aerial ports of embarkation (APOEs), and BBs or to support essential MWRS missions at critical CONUS bases. Prime RIBS units can—

- Provide initial food service, billeting, recreation programs, and mortuary-operations support for up to 1,200 people.
- Can support an independent or dependent combat aviation squadron of 16 to 24 fighter aircraft or a significant aviation deployment less than squadron size in a major deterrent force posture.
- Can support, when augmented, organizational field laundry operations, personnel fitness programs, and tactical field-exchange resale operations.

E&S FORCE MODULE

An E&S module is married to deploying aircraft to the greatest extent possible. The objective is to have Prime BEEF and RIBS CS squadrons and teams inextricably bonded to a deploying flying squadron. When a specific Prime BEEF or RIBS CS squadron or team is tied to home-station or other deploying aircraft, it will be tasked to accompany its flying squadron to the wartime location regardless of the degree of wartime HNS in theater. If it is not tied to home-station or other deploying aircraft and assured HNS is available, the CS squadron or team may be reapportioned to some other wartime location. The basic E&S module consists of 282 people from the following:

- 200 people from a Prime BEEF CS engineering force package.
- 48 people from a Prime BEEF CS fire-fighter force package.
- 34 people from a Prime RIBS CS force package.

ARMY-AIR FORCE ENGINEER CONSIDERATIONS

During force-projection operations, the initial available USAF engineering capabilities in theater will most probably be RED HORSE elements who establish APODs. Prime BEEF and RIBS units will also be quickly deployed to force-projection theater locations to operate at major air bases. The Army engineer staff should consider the following when coordinating joint engineer plans and operations with the Air Force:

- Requesting the latest engineer intelligence data from deployed or deploying RED HORSE elements to assist in identifying force-projection theater Army engineer requirements and capabilities. (Requirements include soils data and the availability of construction materials and HN construction support.)
- Establishing engineer staff links between the AFFOR and Army forces (ARFOR) engineer staff sections through the JTF or theater engineer staff and HQ.
- Providing necessary Army engineer LO support.
- Developing the joint task-organization relationships that enhance RED HORSE and Prime BEEF capabilities, following deployment of Army engineer units.
- Assessing the need for RED HORSE airfield maintenance-and-repair support following arrival of Army construction units in theater.
- Determining if Prime BEEF units need augmentation from Army construction units, especially in the area of RRR.

US NAVY ENGINEER SUPPORT

The naval-construction force (NCF), known as the Seabees, is a generic term applied to the group of deployable naval units that can construct, maintain, and/or operate shore, inshore, and/or deep-ocean facilities. The NCF does this to support the Navy and United States Marine Corps (USMC), and when directed, other agencies of the US government including the Army and unified commanders. The NCF is composed of active and reserve component units.

Air-transportable, task-organized NCF units can deploy on 48 hours notice. Although extensive

horizontal construction cannot be efficiently addressed with air-transportable equipment, priority construction projects can be initiated days before the maritime pre-positioning force (MPF) shipping arrives. Also, acquiring heavy engineer equipment by local contract can augment air-transported NCF assets in a secure environment. The NCF provides—

- Responsive military advanced base-construction support, including operational, logistics, underwater, ship-to-shore, shore, and deep-ocean facilities construction, maintenance, and operation.
- Military construction support of the Marine air-ground task force (MAGTF) operations.
- Defensive and limited offensive operations against overt or clandestine enemy attacks directed towards unit personnel and convoys and camps and facilities that are under construction.
- Battle-damage repair operations.
- Amphibious assault and ship-to-shore construction-support operations.
- Disaster-control and -recovery operations.
- Civic-action employment.

NAVY BASE CONSTRUCTION

Constructing naval bases may fall into two areas: those that are in the country of conflict and those that are off shore of the country where combat is taking place. In-country bases include—

- Logistic terminal facilities.
- Coastal, inshore, and riverine warfare operating bases.
- Communications facilities.
- Ashore fleet air units.
- Other fleet support facilities in the immediate conflict area. Naval air units ashore, such as search and rescue, antisubmarine warfare, carrier onboard delivery, electronic countermeasures, coastal and riverine patrol, communication, and tactical squadrons, have significant construction implications. Naval offshore bases are required to support antisubmarine warfare, mine warfare, reconnaissance, communications, underway replenishment, and logistics support to forward-deployed Navy and Marine forces.

MARINE CORPS SUPPORT

The major combat organization that the NCF supports is the MAGTF. The MAGTF normally consists of the following elements: a MAGTF command and a ground-combat, an aviation-combat, and a CSS unit. OPCON is the only command or support relationship appropriate and authorized when employing NCF units within the MAGTF. The MAGTF commander may place NCF units under the OPCON of a subordinate element commander (ground-combat unit) for missions such as RRR or civil-action team support required to assist stability operations. NCF units employed under the OPCON of the MAGTF element commander will be tasked according to MAGTF construction priorities.

The normal MAGTF/NCF associations established to support MAGTF operations are as follows:

- Marine expeditionary force (MEF) with a naval-construction regiment (NCR) within 30 days.

- Marine expeditionary brigade (MEB) with a naval mobile-construction battalion (NMCB) within 6 days.
- Marine expeditionary unit (MEU) with a NMCB detachment (air detachment [AIR DET]), civic-action teams, other details and detachments as directed by the fleet CINC) within 48 hours. These are general guidelines; the actual NCF organizational relationship with the MAGTF is METT-T dependent.

The MAGTF's general-engineering requirements will normally determine the scope of NCF employment during any operation. NCF units focus on general-engineering tasks and are limited by training and equipment in combat and CS capabilities. Before assigning a mission to an NCF unit, a thorough analysis should be conducted to determine if all aspects of the assignment fall within the capabilities of the NCF organization. NCF units should receive specific tasks or types of tasks on an area- or general-support basis.

The NCF is a construction organization. It has organic defensive capabilities but does not possess the offensive combat capability of Marine Corps engineer units. The following construction capabilities that NCF units provide to the MAGTF are extensive:

- Constructing ammunition supply points and expeditionary bulk-liquid storage facilities.
- Repairing battle damage, to include RRR; expeditionary shelters for operations; and communications, maintenance, warehousing, and personnel support structures.
- Erecting CZ hospitals.
- Improving or constructing ports.
- Installing security fencing.
- Drilling wells.
- Expanding and upgrading unimproved roadway systems.
- Developing aviation support facilities and other forward operating bases to support employing Marine aviation through extensive use of expeditionary airfield matting, pre-engineered and expeditionary shelters, and other semipermanent and permanent construction support.
- Hardening POL and ammunition storage facilities against natural and enemy threats.
- Installing permanent (nonstandard) bridges in relief of tactical, fixed-panel bridging assets. In executing assigned projects, NCF units maintain a significant self-defense capability for their construction sites and can be employed as part of a perimeter defense force. All Seabee units are equipped with small arms. The larger units (NMCBs) have organic, indirect-fire weapons systems (60-millimeter [mm] mortars). Their weapons are identical to those in the USMC inventory. A Marine advisor is resident to the NMCB staff, and NMCB personnel receive semiannual training on military skills and tactics.

AMPHIBIOUS OPERATIONS

All component NCF organizations may be employed during amphibious operations. NCF forces are normally placed OPCON to the Commander, Amphibious Task Force (CATF). They perform construction tasks that assist in the ship-to-shore movement of personnel, equipment, and supplies. NCF units OPCON to the MAGTF commander may be located in both the assault echelon (AE) and the assault follow-on echelon (AFOE). The priority given to construction tasks assigned to NCF units will

determine the echelon in which the NCF will be employed. Additional NCF units may be assigned to the CATF and employed within the amphibious objective area (AOA) in a fleet support or other role. Examples of tasks requiring immediate priority include drilling wells and establishing or upgrading forward operating bases for fixed-wing aircraft.

MPF SUPPORT

The MPF is a task organization of units under one commander formed for introducing a MEB and its associated equipment and supplies into a secure area. The MPF is composed of a command element, a maritime pre-positioning ships squadron, a MEB, and a naval-support element (NSE). As part of their primary mission, NCF units construct and repair MPF logistics terminal facilities. Specific areas include the following:

Beaches

Unlike amphibious operations, logistic considerations drive beach selection for MPF operations. NCF units can rapidly perform the following tasks:

- Upgrading beach egress and road networks to staging and marshaling areas and other inland destinations.
- Constructing expedient survivability structures (earthen berms) for bulk liquids and Class V ammunition storage.

Ports

NCF units can evaluate port capabilities (surface and subsurface) and upgrade facilities to support the MPF operation.

Arrival Airfield

NCF enhancements include—

- Analyzing soil and construction materials, to include evaluating the load-bearing capability of select fill material.
- Constructing and upgrading airfields to ensure the capability for tactical or strategic lift aircraft (C-130, C-141, B-747, C-17, C-5).
- Increasing aircraft staging areas (maximum on ground [MOG]) to ensure that they are sufficient for tactical and strategic aircraft requirements.
- Upgrading roadway systems.
- Constructing expedient survivability structures (earthen berms, revetments) for aircraft, bulk liquids, and Class V ammunition storage.
- Hardening existing facilities.
- Arresting gear site preparation/installation.
- Constructing and improving airfield utilities.

Railheads

NCF tasks include damage control and repair and railhead operations.

NAVY BASE MAINTENANCE

The tasks of the NCF in support of Navy base maintenance include operating and maintaining public works and public utilities, to include water purification and distribution, power generation and distribution, and sewage collection and treatment. Once the base has been substantially constructed, the NCF maintains and repairs structures, makes minor alterations and improvements, and maintains and upgrades LOC.

DISASTER RELIEF

NCF units remain capable to provide disaster relief because of a natural disaster or hostile military action. Each NCF unit is responsible for disaster-control measures to protect its own personnel, equipment, life-support areas, and work sites. It may have to participate in defending other activities. The NCF unit helps make an effective disaster control-and-recovery unit (DCRU), ready to give direct assistance to any military or civilian installation or community during an emergency.

CIVIC ACTION

As part of their normal operations, NCF units may undertake civic-action projects in support of the local populace.

NAVAL-CONSTRUCTION FORCES

NCF units are commanded by officers of the Navy Civil Engineer Corps. Enlisted personnel are primarily from the naval occupational field 13, construction. Occupational field 13 has builders, construction electricians, construction mechanics, engineering aids, equipment operators, steelworkers, and utilities men.

Naval-Construction Battalion Commanders

The Commander, Naval Construction Battalion, Pacific Fleet (COMCBPAC) and Commander, Naval Construction Battalion, Atlantic Fleet (COMCBLANT) exercise operational and administrative control of assigned NCF components. They provide policy guidance concerning—

- Leadership and discipline.
- Administration.
- Force-projection planning.
- Readiness.
- Military and technical training.
- Unit employment, deployment, and scheduling.
- Doctrine, tactics, and procedures.

- Equipment management.
- Logistics support.

Naval-Construction Brigade (NCB)

A NCB exercises administrative and OPCON of two or more NCRs operating in a specific geographic area or in support of a specific military operation. The NCB provides an initial review of plans, programs, and construction capabilities; assigns priorities and deadlines; and directs distribution of units or materials and equipment.

Naval-Construction Regiment

A NCR exercises administrative and OPCON of two or more NMCBs operating in a specific geographic area or operating in support of a specific military operation. The NCR—

- May be OPCON to a MEF.
- Develops construction execution plans.
- Assigns construction projects to its units.
- Monitors progress.
- Performs quality control.
- Directs redistribution of units, equipment, and materials.
- Reviews plans and operations reports.
- Maintains greater planning, estimating, and engineering capabilities than the battalions.

Naval-Construction-Force Support Unit (NCFSU)

The NCFSU provides operational construction logistics support to the deployment area for a NCR of up to four NMCBs. The NCFSU—

- Controls requisitioning, expediting, receiving, issuing, and delivering construction (Class IV) materials.
- Provides maintenance support for NCF auxiliary construction and transportation equipment.
- Overhauls and does specialized repair of equipment components.
- Provides the operation and maintenance capabilities for rock crushers, asphalt and concrete plants, large paving machines, and long-haul transportation, when required.

Naval Mobile-Construction Battalion

The NMCB—

- Provides responsive military construction support to Navy, Marine Corps, and other military forces.
- Conducts battle-damage repair operations (including RRR) and defensive operations and constructs base facilities, as required by METT-T.
- Conducts disaster-relief operations and civic-action projects as required.

- Constructs, repairs, improves, and maintains LOC, to include bridges, road, and rail systems.
- Constructs, repairs, improves, and maintains fixed-wing and rotary-wing airfields, landing sites, airdrop sites, and airfield support structures/facilities.
- Upgrades, repairs, and replaces POL and bulk-liquid systems.
- Constructs ammunition supply points, water-storage and -distribution facilities, cantonments, defensive structures, throughput systems (air, rail, road, and water terminals), and other support facilities.
- Can function as an integral unit of the NCR, or operate independently.
- Provides specialized, task-organized detachments up to one-half its organizational size to address specific support requirements.
- Can deploy, initially 85 percent of each NMCB, as an air echelon via aircraft (about 87 C-141 equivalents), with the remaining 15 percent following via surface transportation.

NMCB Air Detachment

The AIR DET is a task-organized advanced element of a NMCB. It is composed of 91 personnel and 38 items of civil-engineering support equipment. It is limited to 250 to 300 short tons (14 C-141 equivalents) of air shipment. The AIR DET is used to repair immediate war damage and construct urgent projects required by major operational plans.

NMCB Civic-Action Team (Seabee Team)

The civic-action Seabee team is a small, highly mobile construction unit that is task-organized from NMCB assets. The civic-action team provides socioeconomic community development, disaster relief, and technical assistance. The team supervises nation-assistance construction projects and conducts on-the-job training and classroom instruction in third-world nations.

Amphibious-Construction Battalion (PHIBCB)

An PHIBCB provides engineering support to the naval beach group (NBG) during the initial assault and landing phase of amphibious operations. The PHIBCB provides designated elements to the CATF, supports the NBG, and assists the landing-force support party (LFSP), or the NSE, in operations that do not interfere with the primary mission. There are two PHIBCBs, one each under the OPCON of the Commander in Chief, Pacific Fleet (CINCPACFLT) and Commander in Chief, Atlantic Fleet (CINCLANTFLT). They are readily organized to support specific tasks. When employed in support of amphibious operations, they become essential elements of the NBG, the naval component of the LFSP. An PHIBCB supports a MAGTF landing over two covered beaches during the amphibious assault. PHIBCBs maintain organizational command integrity under all assignments.

Construction-Battalion Maintenance Unit (CBMU)

The CBMU maintains, operates, and repairs public works, utilities, and other facilities at an established advance base after the NMCB units that started the construction have departed. The CBMU may be attached to the NMCB to help complete the facilities that it will subsequently operate and maintain. When employed, CBMUs carry out their assigned functions under the command of the advanced base

commander or naval component commander. Typical CBMU functions include, but are not limited to, the following:

- Designating public works responsibilities at a Navy base, Marine base, or other installations.
- Maintaining, repairing, and constructing, on a limited basis, structures and grounds, such as waterfront facilities, runways, taxiways, parking aprons, and helicopter pads (including matting surfaces).
- Operating and maintaining the base utilities systems except for expeditionary systems such as the Amphibious Assault Fuel System (AAFS) and Tactical Airfield Fuel Distribution System (TAFDS) and water-supply support-system equipment.
- Performing engineering services for the base, as requested.

Underwater-Construction Team (UCT)

The UCT constructs, inspects, maintains, and repairs underwater facilities. Generally, all underwater engineering, construction, and repair fall under the control of the UCT. Each UCT is organized and equipped to be self-sufficient in underwater-construction capabilities for the various tasks anticipated. Outfitting includes construction and underwater weight-handling equipment, underwater and terrestrial-construction tools, diving equipment, safety equipment, and a standard allowance of infantry gear. The UCT can deploy as an integral unit or as individual construction detachments in support of other NCF, MPF, MAGTF, or naval units. Tasks include supporting underwater surveillance systems to waterfront facilities inspections.

Construction Battalion Unit (CBU)

A CBU provides engineering support that other NCF units do not provide. It is also used to provide manpower pools to support NMCBs and Navy fleet hospitals.

ARMY-NAVY ENGINEER CONSIDERATIONS

During force-projection operations, the initial US naval engineering capability available in theater will most probably be NMCB AIR DETs and MAGTF amphibious forces. NMCBs will also be quickly deployed to force-projection theater locations to construct necessary naval facilities. The Army engineer staff should consider the following when coordinating joint engineer plans and operations with the Navy:

- Requesting the latest engineer intelligence data from deployed or deploying NMCB AIR DET elements to assist in identifying force-projection theater Army engineer requirements and enemy engineer capabilities. (Requirements include soils data, availability of construction materials, and HN construction support.)
- Establishing engineer staff links between the Navy forces (NAVFOR) and ARFOR engineer staff sections through the JTF or theater engineer staff and HQ.
- Providing necessary Army engineer LO support.
- Developing the joint task-organization relationships that enhance NCR capabilities following the deployment of Army corps engineer units.
- Assessing the need for NMCB support following the arrival of Army construction units in theater.
- Determining if NMCB units need augmentation from Army construction units.

- Developing procedures for Army engineer units to acquire additional Class IV construction materials from NCFSUs.

US MARINE CORPS ENGINEER SUPPORT

The Marine Corps is organized into regiments, each of which contains a division, an aircraft wing, and a force-service support group (FSSG). Each of these contain organic engineer support. The Marine Corps component of the theater command or JTF is normally controlled by a commander of the Marine Corps forces (MARFOR). The regiment forms a MAGTF to meet force-projection operations. Components of a MAGTF may include a MEF, a MEB, and a MEU.

MARINE AIR-GROUND TF

The Marine regiment may form a MAGTF, which is a task organization of Marine forces (division, aircraft wing, and service support groups) under a single command and structured to accomplish specific missions. NCF units may be placed under OPCON to the MAGTF commander who may place them under the OPCON of a subordinate element commander (ground combat element) for missions such as RRR or civil-action team support required to assist stability operations. NCF units employed under OPCON to the MAGTF element commander will be tasked according to MAGTF construction priorities. The MAGTF normally consists of a command element (CE), a ground-combat element (GCE), an aviation combat element (ACE), and a CSS element (CSSE).

Command Element

The CE is the MAGTF HQ and is a permanent organization composed of the—

- Commander.
- General or executive and special staff sections.
- HQ section.
- Requisite command, control, and coordination section for effective planning and execution of operations by the other three elements of the MAGTF.

Aviation-Combat Element

The ACE is task-organized to provide all or a portion of the functions of Marine Corps aviation in varying degrees, based on the tactical situation and the MAGTF mission and size. These functions are air reconnaissance, antiair warfare, and control of aircraft and missiles. The ACE is organized around an aviation HQ and varies in size from a reinforced helicopter squadron to one or more Marine aircraft wings. It includes those aviation commands (including air-control agencies), combat, CS, and CSS units that the situation requires. Normally, there is only one ACE in a MAGTF.

Ground-Combat Element

The GCE is task-organized to conduct ground operations. It is constructed around an infantry unit and varies in size from a reinforced infantry battalion to one or more reinforced Marine divisions. The GCE also includes appropriate CS and CSS units. Normally, there is only one GCE in a MAGTF.

Combat-Service-Support Element

The CSSE is task-organized to provide the full range of CSS necessary to accomplish the MAGTF mission. The CSSE can provide the following services:

- Supply.
- Maintenance.
- Transportation.
- Deliberate engineering.
- Health.
- Postal.
- Disbursing.
- EPW.
- Automated information systems.
- Exchange.
- Utilities.
- Legal.
- Mortuary. The CSSE varies in size from a MEU service-support group (MSSG) to a FSSG. Normally, there is only one CSSE in the MAGTF.

MARINE EXPEDITIONARY FORCE

A MEF, the largest of the MAGTFs, normally is built around a division/wing team. However, it can include several divisions and aircraft wings, together with appropriate CSS organizations. The MEF is capable of conducting a wide range of amphibious assault operations and sustained operations ashore. It can be tailored for a wide variety of combat missions in any geographic environment.

MARINE EXPEDITIONARY BRIGADE

A MEB is a task-organized organization normally built around a Marine regimental landing team, a provisional Marine aircraft group, and a logistics support group. It is capable of conducting amphibious assault operations of a limited scope. During potential crisis situations, a MEB may be forward deployed afloat for an extended period to provide an immediate combat response.

MARINE EXPEDITIONARY UNIT

A MEU is a task organization normally built around a battalion landing team, a reinforced helicopter squadron, and a logistic support unit. The MEU fulfills routine afloat deployment requirements, provides an immediate reaction capability for crisis situations, and is capable of relatively limited combat.

MARINE COMBAT-ENGINEER BATTALION (CEB)

Each Marine division is supported by one CEB that will provide close combat support and limited general-engineering support for the division through task-organized combat-engineer elements for ground-combat operations. Each Marine infantry regiment (three per division) is supported by a combat-engineer company (CEC). The CEB enhances the M/CM/S of the Marine division through close combat-engineering support and provides limited general-engineering support required for the Marine division to function. Table 4-1 lists the tasks of the CEB.

The CEB consists of a headquarters and service (H&S) company, an engineer-support company (ESC), and four CECs. The CEC provides close combat support of an engineering nature, as necessary, to meet the essential requirements of an infantry regiment and other division elements in combat operations. It contains a company HQ and three combat engineer platoons. The ESC—

- Provides personnel, equipment, and appropriate task units to the CECs in support of operational requirements.
- Provides minimum potable water for the Marine division and electrical power for designated elements of the Marine division.
- Is organized into a company HQ section, an equipment platoon, a motor transport platoon, and a utilities platoon. The Marine engineer forces are currently undergoing some organizational changes. The CEB will lose its support company and one CEC to the ESB in the FSSG.

MARINE ENGINEER-OPERATIONS DIVISION

Each Marine aviation wing contains a wing support group; the group contains wing support squadrons for both fixed- and rotary-wing aircraft, and the squadrons contain engineer-operations divisions. An engineer-operations division provides organic engineer support to the wing only, deploys with the wing, and will normally not assist in other engineering operations. It provides all essential aviation ground-support requirements and has the capability to perform—

- Engineer reconnaissance and survey.
- Repair, improvement, and maintenance of existing road nets.
- Construction and maintenance of expedient roads and drainage systems.
- Construction and maintenance of vertical takeoff and landing (VTOL) facilities.
- Construction and maintenance of mission-essential base-camp requirements.
- Technical and equipment assistance for erecting shelters.
- Utilities support, to include essential mobile electric-power, water, and hygiene support.
- Equipment and personnel required for RRR.
- Material handling equipment (including 16 cranes and 31 forklifts) to support base operations.
- Limited mine-detection capability and combat-engineering services. The engineer-operations division is task-organized into seven separate branches: draft/survey, heavy equipment/material handling, utilities, electrical, reference, water-support hygiene, and construction.

Table 4-1. CEB tasks

Operations and Tasks
• Mobility. Conducts engineer reconnaissance and supports intelligence collection within the division's zone. Plans, organizes, and coordinates the assault breaching of explosive and nonexplosive obstacles from the high water mark inland. Employs assault bridge systems. When augmented, employs other standard bridge systems. Provides expedient repair and reinforcement of existing bridges. Constructs expedient, short span bridges from local materials in support of ground combat operations. Provides temporary repair of existing roads and limited new construction of combat roads and trails.
• Countermobility. Plans, organizes, and coordinates constructing simple and compound explosive and nonexplosive obstacle systems. Plans and constructs obstacles requiring special engineer equipment or technical skills. Performs specialized demolition missions beyond the capability of other division units.
• Survivability. Provides technical assistance and necessary equipment for developing temporary protective positions for personnel and equipment.
• General Engineering Support. Provides essential construction support, which is temporary in nature and designed to meet minimum combat requirements. Provides utility support to include mobile electric power equipment and potable water for essential troop consumption, bath services, and equipment operation and maintenance (O&M) requirements. Constructs and improves expedient VTOL sites to support the division's operations.

MARINE ENGINEER-SUPPORT BATTALION (ESB)

Each FSSG has an organic ESB. The ESB is organized to plan, coordinate, and supervise the general-engineering and supply-support functions of the battalion. It is structured to facilitate task organization for operations that the battalion conducts. The ESB provides GS to the MEF (to include M/CM/S enhancements and explosive-ordnance-disposal [EOD] support) and GS to the handling, storage, and distribution of bulk Class I (water) and bulk Class III supplies. The ESB is capable of—

- Conducting engineer reconnaissance.
- Constructing, improving, and maintaining airfields, encampments, and other support facilities.
- Conducting mobility enhancement operations, to include constructing, improving, and maintaining LOC and MSRs.
- Providing Class III bulk-fuel support, to include receiving, storing, and distributing bulk-fuel products.
- Providing utilities support, to include mobile electric power beyond the supported units' capabilities and electrical power distribution within camps and support areas.
- Providing water purification and Class I (water) bulk storage and distribution.
- Providing survivability enhancements, to include constructing protective structures.
- Installing and/or supervising installing standard and nonstandard fixed panel and floating bridging, which includes planning and controlling bridging operations.
- Providing bath and laundry services.
- Providing EOD support.
- Constructing field-expedient deception devices.
- Conducting countermobility operations by installing obstacles, which includes minefields and nonexplosive obstacles.
- Conducting mobility operations, to include breaching, reducing, and removing explosive or nonexplosive obstacles.
- Providing specialized demolition operations. The ESB is structured into seven separate companies to facilitate task organization:
- An H&S company provides C2, administration, and command support functions for the rest of the battalion. It also provides extensive EOD support to the MEF with a separate EOD platoon.
- A bridge company provides technical assistance/supervision for constructing fixed-panel and floating-bridge equipment. Organic equipment includes nine bridge-erection boats, three M4T6 sets, six floating foot bridges, and six MGB sets.
- An ESC provides DS maintenance support for specified equipment organic to the battalion, DS transportation and services support to the battalion, and GS or reinforcing augmentation, as required, to the engineer companies of the battalion. This is a large company organized into five separate platoons: utilities, maintenance, motor transport, engineer equipment, and water supply.
- A bulk-fuel company provides general Class III supply support to the MEF.
- Three engineer companies provide general-engineering support of a deliberate nature to the MEF. It is organized into a HQ section, an equipment platoon, and two engineer platoons.

ARMY-MARINE CORPS ENGINEER CONSIDERATIONS

Marine division CEBs, as part of MAGTF operations, probably will be the initial USMC engineering capabilities available in theater during force-projection operations. ESBs will also be quickly deployed to force-projection theater locations to construct necessary Marine facilities. The Army engineer staff should consider the following when coordinating joint engineer plans and operations with the Marine Corps:

- Requesting the latest engineer intelligence data from deployed or deploying Marine CEB and ESB elements to assist in identifying force-projection theater Army engineer requirements and enemy engineer capabilities. (Requirements include threat mine and obstacle data, soils data, availability of construction materials, and HN construction support.)
- Establishing engineer staff links between the MAGTF, MARFOR, and ARFOR engineer staff sections through the JTF or theater engineer staff and HQ.
- Providing necessary Army engineer LO support.
- Developing the joint task-organization relationships that enhance Marine engineer capabilities following the deployment of Army corps engineer units.
- Assessing the need for CEB and ESB support following the arrival of Army combat and construction units in theater.
- Determining if ESB units need augmentation from Army combat and construction units.
- Developing procedures for Army engineer units to be able to acquire additional Class IV construction materials from ESBs.

MULTINATIONAL ENGINEERS

The type of available engineers from other nations to support multinational operations varies significantly. National armies generally have a mix of combat and/or construction engineers formed into company- and battalion-sized elements. Combat and construction elements may be integrated within maneuver battalions or formed into separate battalions. Levels of training and equipment fielding also vary. Army engineers usually have greater combat and construction capabilities than other nations.

MULTINATIONAL ENGINEER CAPABILITIES

NATO and American, British, Canadian, and Australian (ABCA) engineer capabilities are well known and available. Standardization agreements (STANAGs) between national armies facilitate engineer interoperability and cooperation. The capabilities of engineers of other nations are normally available through intelligence channels or formal links with the nations concerned. Several nations have engineers that are experts in specific combat-engineering tasks such as mine detection and removal. Other national engineers are focused on specific missions such as disaster relief.

MULTINATIONAL ENGINEER C2

Depending on the multinational force arrangement in theater, Army engineers may control or work closely with engineers from other nations. Multinational engineer C2 relationships are established to foster cooperation and share information. Critical to this process is providing adequate US engineer LO support, including linguist support, communications equipment, and transportation.

MULTINATIONAL ENGINEER CONSIDERATIONS

During force-projection operations, the initial engineers in theater will most likely provide the HN engineering capabilities. As Army engineers deploy into theater, they may be joined by allied and coalition engineers. The Army engineer staff should consider the following when coordinating multi-national engineer plans and operations:

- Requesting the latest intelligence information concerning the HN, allied, and coalition engineers' structures and logistics requirements.
- Requesting the latest engineer intelligence data from the HN or deploying allied and coalition engineer elements to help identify force-projection theater Army engineer requirements and enemy engineer capabilities. (Requirements include threat mine and obstacle data, soils data, construction materials availability, and HN construction support.)
- Establishing multinational engineer staff links between the Army, HN, allied, and coalition engineer-force staff sections through the JTF or theater engineer staff and HQ.
- Providing necessary Army engineer LO support.
- Developing the multinational task-organization relationships that enhance HN, allied, and coalition engineer capabilities following the deployment of Army engineers.
- Assessing the need for HN, allied, and coalition engineer support following the arrival of Army combat and construction units in theater.
- Determining if multinational engineer units need augmentation from Army combat and construction units.
- Developing procedures for Army engineer units to be able to support multinational engineers with additional Class IV construction materials and engineer equipment.

CONTRACTED CIVILIAN ENGINEERS

The US military can contract civilian-engineering support, as required, based on the threat situation and available resources. These contracts relieve the work load on US military engineer units in such areas as logistics base construction, real estate and facilities acquisition, RPMA, and demining operations. Oversees construction and other contracting services are available through the USACE, the Naval Facilities Engineering Command (NAVFAC), or the Air Force regional civil-engineer (AFRCE) CCAs, depending on the theater location.

CONTRACT CONSTRUCTION AGENTS

CCAs will maintain control of contractor operations. Various service CCAs throughout the world perform contract construction. Each service has its own geographic AO, but in any one area, only one CCA is designated. The Department of Defense (DOD) has assigned regional contract construction capabilities as follows:

- The USACE is responsible for Northeast and Central Asia, Central and Northern Europe, North and South America, the Middle East, and Northeast Africa.
- The NAVFAC is responsible for the Iberian Peninsula, the South Pacific, the Caribbean, Antarctica, Southeast Asia, and the Mediterranean Basin.
- The AFRCE is responsible for the UK.
- The NAVFAC is responsible for the Horn of Africa. CCAs will establish contract-management offices in support of force-projection operations. The office may be placed in support of the senior theater engineer HQ in theater or may operate independently. CCAs will be deployed as early as possible to initiate necessary contracting operations.

LOGISTICAL CIVIL AUGMENTATION PROGRAM (LOGCAP)

LOGCAP is an Army capability that provides responsive contract capabilities to augment US forces with facility and logistics services during war and MOOTW. The Army currently operates the LOGCAP. The USACE provides program management, coordinates LOGCAP requirements with supported major Army commands (MACOMs), and administers the LOGCAP contract. The MACOM Assistant Chief of Staff, G3 (Operations and Plans) (G3), Assistant Chief of Staff, G4 (Logistics) (G4), engineer, and comptroller are key players in developing LOGCAP requirements and ensuring for the appropriate mix of contractor and troop support. The three major activities supported by the worldwide LOGCAP contracts are—

- Facilities operations, maintenance, repair, and construction.
- Nonfacility logistics services.
- Contractor planning expertise to assist contingency planners. LOGCAP is especially suited to support reception, onward movement, and sustainment facilities. LOGCAP can augment engineer units by operating Class IV supply yards, supplying construction equipment, providing facility engineer support, and supporting theater construction.

CONTRACTED CIVILIAN-ENGINEER CONSIDERATIONS

The challenge for engineer planners and executers is to achieve the optimal mix of contractor and military engineer-unit capabilities. Construction contractors are best suited for the longer-duration, heavy construction work in stabilized environments. In turn, contractors leverage local resources (labor and materiel) to minimize costs and impacts on intratheater lift and port facilities. The contractor's presence contributes significantly to local-area political and economical stabilization and thereby reduces the need for the presence of US security forces. In turn, the US commander in theater must recognize the need for US military oversight of contract and contractor activities in the areas of project management, financial management, quality assurance, and audit.

During force-projection operations, extensive contracted civilian-engineer capabilities will probably be

available only after D+30 due to mobilization and deployment time lines. Civilian-engineer contracting may be available sooner when deliberately and properly planned for during permissive entry conditions. As Army engineers deploy into the theater, they may be joined by contracted civilian engineers. The Army engineer staff should consider the following when coordinating engineer plans and operations with contracted civilian engineers:

- Requesting the latest engineer intelligence data from any contractors working in the theater to help identify force-projection theater Army engineer requirements and enemy engineer capabilities. (Requirements include availability of real estate, construction materials, and facilities; data on threat mines and obstacles and soils; and construction support from the HN.)
- Establishing engineer staff links between the Army and contracted civilian-engineer staff through the JTF, USACE, or NAVFAC and the theater engineer staff and HQ.
- Providing necessary Army engineer LO support.
- Developing time lines that quickly phase in contracted civilian-engineer capabilities to relieve deployed Army engineer units of some responsibilities.
- Assessing the need for additional contracted civilian-engineer support following the arrival of Army combat and construction units in theater.
- Determining if contracted civilian engineers need augmentation from Army combat and construction units.
- Developing procedures for Army engineer units to draw on contracted Class IV construction materials and engineer equipment.

US GOVERNMENTAL AGENCIES, NGO, PVO, AND UN AGENCIES

Military engineers may need to coordinate their activities with US government agencies, NGOs, PVOs and UN agencies according to the operational mandate or military objective. In all cases, authority must exist for direct coordination. Interagency relationships must be established through negotiation. Agreements should be reduced to writing as memoranda of understanding or terms of reference to ensure understanding and avoid confusion. Most agreements will be made at the unified command or JTF level. These agreements will normally have serious legal restrictions on using military personnel and equipment. These agencies and organizations may have unique engineer capabilities that could be used as part of the overall operational effort. More often than not, these agencies and organizations may request extensive engineer support of their activities and programs. It is critical that an effective engineer liaison is established with the force HQ civil-military operations center (CMOC) to coordinate and execute any engineer support to and from these agencies.

CHAPTER 5

Operational Engineering

THEATER DEVELOPMENT

An adequate sustainment base is essential for success in any operation. The Army's ability to marshal, transport, and distribute large quantities of materiel and maintain assigned personnel and equipment can make the difference between victory and defeat in conflict or war. The concept of materiel need in large quantities transcends conflicts and war. Large quantities of Class IV force-protection, obstacle, and force bed-down construction materiel are significant in contingency operations. Establishing a theater sustainment base depends greatly on the extent and nature of the existing military and HN capabilities in the theater before hostilities begin. In lesser-developed regions of the world, the sustainment base may have to be developed at the same time as combat and operational-level forces are deploying. In forward-presence theaters (such as Korea) HNS agreements assist in operating and maintaining the sustainment base. Force reception, onward movement, and sustainment facilities are most critical during the initial stages of any potential operation.

PERSPECTIVE:

Initially, the Central Command (CENTCOM) CINC and staff determined that Operation Desert Shield was to be sustained in the theater by the premise of "minimum essential" support from troop units and maximum support from HN and contracting sources. The 20th Engineer Brigade's (corps) (airborne) commander served as the theater engineer, in addition to commanding engineer support to the forward fight. The brigade's primary mission was to provide theater troop bed-down and logistic base-construction support. The brigade worked closely with the USACE Middle East/Africa Projects Office (MEAPO), US Army Forces Command (FORSCOM), and Third US Army engineer staffs to take care of theater needs. Liaison was also maintained with the US Army Reserve, 416th ENCOM, which was alerted but not mobilized and not deployed until December 1990.

The CINC made decisions not to deploy theater engineer construction units, initially, because of their large strategic lift requirements. During the initial stages of Operation Desert Shield, it became quickly apparent that HNS and contracting would not be able to handle the massive amount of horizontal construction needed to logistically sustain and move forces in theater. One engineer group with three combat heavy engineer battalions was

deployed and became fully engaged in supporting the XVIII US Corps's sustainment mission. The 20th Brigade, MEAPO, and Third US Army engineer staffs were not adequately staffed to control increasing theater-engineer requirements. When VII US Corps was alerted for movement to Saudi Arabia from Europe, a theater-engineer force structure was developed, approved, mobilized, and deployed by the CINC. This force structure included the 416th ENCOM, one engineer brigade (theater army); three more engineer groups; seven more combat heavy engineer battalions; a composite engineer battalion; and numerous companies, teams, and detachments. Several table(s) of distribution and allowances (TDA) engineer units were also deployed to provide theater power and installation support. The 22d Support Command (SUPCOM) engineer served as the CENTCOM forward engineer with contract responsibility for all services, since the command was not adequately staffed to manage the volume of construction by the other services.

ENGINEER FUNCTIONS

The ASCC tailors the engineer structure to theater requirements. All engineer units (combat, construction, and topographic) are focused on operations in the CZ. They also support the theater by providing general-engineering support. Engineers must be closely tied into current and future operational planning and have their own C2 structure to ensure the timely and proper execution of the intent and scheme of maneuver. Engineers at the operational level are responsible for constructing, maintaining, and rehabilitating the theater support base. This includes support to other services and agencies and other military forces in joint and multinational TOs. The ability of CSS units to conduct sustainment operations, as well as movement and sheltering of combat/CS forces, depends on adequate, responsive engineer support.

The number and type of operational-level engineer support units depend on the size of the support base required, HN infrastructure, mission, availability of existing engineer support brought to the TO, and perceived threat in the rear area. Operational-level engineer units provide—

- Topographic support to the theater.
- Troop construction and repair to all US elements in the COMMZ.
- Contract construction support.
- General-engineering and M/CM/S support to tactical-level organizations, when required.

TOPOGRAPHIC SUPPORT

The topographic battalion is assigned to the senior engineer commander. The CINC establishes topographic priorities. Topographic missions include analyzing terrain for IPB and tactical-decision aids, updating existing maps and charts, and establishing geodetic survey controls in the operational area. The topographic battalion is tailored to meet the requirements of the particular operational area. This unit supplements and enhances the DMA effort by compiling data from various sources into special-purpose topographic products such as—

- Maps.

- Map overprints.
- Overlays (line of sight, cross-country movement, cover and concealment, route analysis, and obstacles).
- Terrain studies.
- Satellite image-based map substitutes.
- Digital data for C2 and mission-planning and -rehearsal systems.
- Geodetic survey support for precise positioning of weapons. The DMA or HNS, through international agreements, provides all standard topographic products used in support of combat operations.

  The topographic battalion assigned to the ENCOM provides the ASCC staff with a team for planning requirements. This includes the assistant topographic engineer, who helps the ASCC engineer arrange topographic support between the ASCC and DMA, other services, and allied organizations. FM 5-105 provides a detailed explanation of topographic support.

CONSTRUCTION PLANNING AND MANAGEMENT

The CINC establishes broad plans and policies for theater construction in consonance with guidance from the Joint Chiefs of Staff (JCS). They are based on coordinated planning by construction representatives from all service components.

US ARMY CORPS OF ENGINEERS

The USACE provides support to the ASCC and engineer units with facilities-management and construction missions. The theater USACE element commander may support multiple commanders within the ASCC and other service components. The USACE forward-element missions include—

- Planning and designing theater facilities for contract or troop construction.
- Managing the contract construction program.
- Ensuring quality assurance for contract construction and troop construction, if requested.
- Planning for and acquiring real estate.
- Obtaining LOGCAP contract management.
- Serving as the administrative contracting officer (ACO) for LOGCAP construction.
- Ensuring that LOGCAP and a separate ACO provide technical support for logistics services, if required.
- Ensuring that users of the TCMS have facilities technical support.
- Managing and accounting for all appropriated military construction (MILCON) funds provided for construction execution in theater.
- Providing a USACE liaison to the ASCC staff engineers.

CONSTRUCTION POLICIES AND PROCEDURES

The CINC establishes construction standards and policies that guide engineer operations whether Air Force, Navy, or Army units perform them. These standards and policies provide for allocating limited resources to accomplish the most vital tasks. The CINC also establishes priorities for various types of facilities. These priorities guide subordinate engineer elements in prioritizing the missions given to them. Each engineer HQ must prioritize its requirements according to operational-area priorities and elevate any conflicts up the chain of command for resolution.

CONSTRUCTION STANDARDS

Generally, wartime facility requirements are satisfied, in priority, by—

- Obtaining maximum use of existing facilities (controlled by the US/HN).
- Modifying existing facilities rather than constructing new ones.
- Applying austere design and construction techniques.
- Using an appropriate balance of US engineer troop units and contractors. Army forces deployed to developed areas capitalize on an established infrastructure and maximize the use of existing facilities. The construction effort is focused on facility modification and battle-damage repair, making maximum use of available HN manpower, equipment, and materials.

  Army forces deployed to lesser-developed operational areas rely more on construction of new austere facilities. The construction effort is focused on initial standard (up to 6 months expected use) or temporary standard (up to 24 months expected use) construction and battle-damage repair. Again, HNS is sought, but it may be less available than in developed areas. In undeveloped theaters, a LOGCAP contractor may be available to assist in accomplishing theater construction and/or repair requirements.

CONSTRUCTION PRIORITIES

Engineer work requirements throughout the operational area normally exceed capabilities. Establishing a broad priority system by the CINC assists in applying resources against only those tasks that are most critical to success. Table 5-1 provides a framework for assessing the priority of required engineer support.

CONSTRUCTION MANAGEMENT

The CINC may retain control at his level or delegate construction management to the ENCOM. In the absence of the ENCOM, the senior operational-level engineer commander is normally delegated to perform this function. The ENCOM manages all construction, repair, and facility modifications in the COMMZ. This provides centralized control with decentralized execution. The ENCOM also manages all troop, contract, and HN construction repair operations in the COMMZ. This structure ensures that theater-construction assets are employed according to theater priorities. The ENCOM responsibilities include—

- Managing troop construction.

Table 5-1. Engineer support priorities in theater

Priority	Implications of Nonsupport
1.	High loss of life or combat defeat.
2.	Degraded combat effectiveness or increased vulnerability on the battlefield.
3.	Degraded noncritical CSS.

- Managing contract construction.
- Integrating prioritized construction projects from all component commanders into a regional program.
- Prioritizing US requests for HN construction support in the region.
- Managing and monitoring procurement of Class IV construction materials. Positioned within the established theater-support structure, the ENCOM, with its subordinate engineer units, provides the framework for the following organizational structure:
- The ENCOM or the senior operational-level engineer commander.
- The engineer brigade (TA) or the first subordinate engineer commander/unit.
- The engineer group (construction) or the second subordinate engineer commander/ unit. Figure 5-1 shows this organization.

WARTIME-CONSTRUCTION PROCEDURES

Decentralized execution of the theater-construction program requires that work requests enter the system at the lowest possible level. Alignment along area-support boundaries provides established conduits through the ASG. If the ASG cannot accomplish the work with its organic assets, it prioritizes the requests and provides them to the supporting engineer group. When the work cannot be done, the engineer group enters the requests into a construction/repair backlog and passes them to the engineer brigade for resolution.

The civil-affairs teams receive HN requests for US engineer support and pass them to the engineer group for execution. The engineer group enters these requests into its work load, according to established theater priorities. Troop, contract, or HN effort accomplishes the requests, as applicable.

Other US services submit work requests directly to the engineer brigade in charge of the AO. The engineer brigade prioritizes these requests, according to the theater priorities, and provides them to the engineer group who supports the area requiring the work. When the work seemingly cannot be done, the ENCOM resolves the problem.

The ENCOM may receive work required in support of the theater base-development plan (BDP). The ENCOM prioritizes the work and passes it to the appropriate engineer brigade for accomplishment. They may also redistribute backlog work to other engineer brigades that are not fully committed.

This two-way flow of backlog and tasking identifies the required work load to each level of the organization. The engineer group can do objective scheduling according to theater priorities. Only an exceptional case needs to be referred to higher HQ to settle a question of priority. FM 5-116 contains a detailed flow chart that summarizes these procedures.

GENERAL CONSTRUCTION PRINCIPLES

When planning construction projects in a TO, you should—

- Accomplish construction within the allotted time and use a minimum of materials, equipment, and manpower.
- Make maximum use of the installations and facilities described in the Army Facilities Components

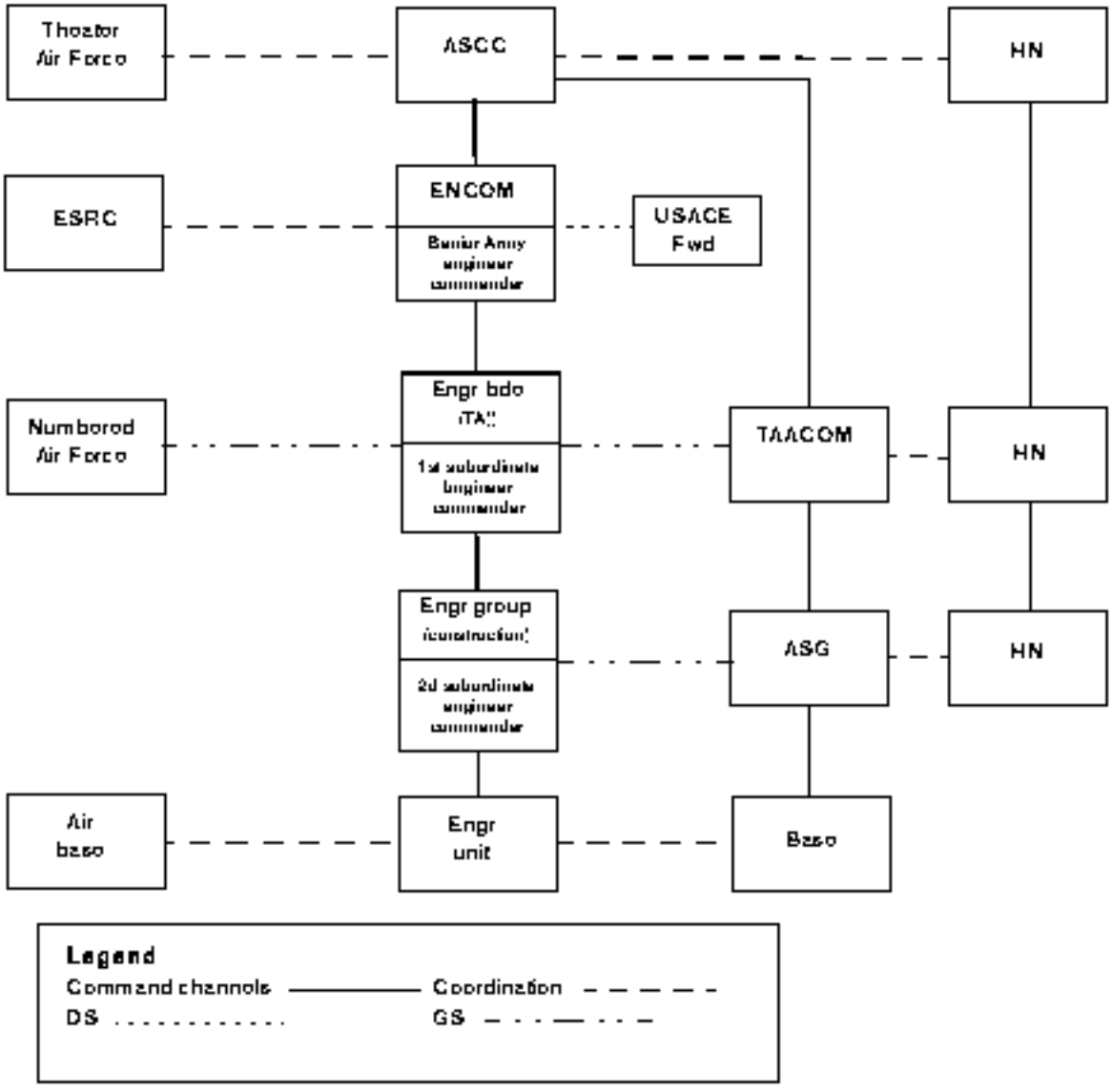


Figure 5-1. Engineer support relationship

System (AFCS) and other standard drawings when they are applicable.

- Use simple, flexible designs.
- Incorporate available materials in designs (either locally procured or as normal supply items).
- Follow construction standards that the theater commander establishes.
- Repair or modify existing facilities before constructing new ones.
- Provide only the minimum facilities consistent with military necessity.
- Avoid creating lucrative targets; disperse the facilities.
- Plan camouflage and deception during site selection and construction.

TROOP CONSTRUCTION MANAGEMENT

Theater-specific standard designs are usually developed at the ENCOM for use throughout the theater. Construction directives may be issued by the ENCOM; however, this is normally only for large installation requirements, such as a base camp or logistical facility. The engineer group issues construction directives to subordinate units that contain the specifications and drawings needed to construct the new facility. These directives are generally for construction only. Occasionally, the engineer group issues directives for design and construction. These are normally limited to upgrading or repairing existing facilities or site adaptation of standard designs.

The engineer group staff inspects unit projects for compliance with plans, specifications, and sound construction practices. If support from a construction-support company, a dump-truck company, a pipeline-construction company, or a port-construction company is required, the engineer group issues a separate directive to that unit specifying the support it is to provide.

CONSTRUCTION MATERIALS

Engineer units are unable to perform their missions without adequate logistics support. If engineer commanders are to be successful in the TO, they must understand the logistics system and know where to go for required logistics support. Massive requirements for Class IV construction materials distinguish engineer requirements from those of other units in the theater.

Adequate Class IV supplies are central to the ability of operational-level engineer units to construct and maintain facilities to support the sustainment base. For this reason, the ENCOM usually plays a key role in managing theater-construction materials allocation. Engineers look to their supporting material management center (MMC) for most of their Class IV construction items. Adequate Class IV supplies and timely delivery of the materials to the work sites are central to mission accomplishment. Engineers must be very specific with their requirements and work with their supply support activity to develop a delivery plan that gets the required materials to the right place at the right time to keep engineers working. Engineer participation in local purchasing and cooperation with the ASCC are key to adapting and substituting locally available materials.

Unlike other classes of supply, Class IV construction materials are not provided based on documented consumption rates, and there are no anticipated surge rates. It may take several months between initiating the request and for the materials to arrive in theater. Therefore, it is crucial that operational-level engineers estimate their requirements as soon as possible and initiate the requests before deployment or

operations. Class IV procurement will often take on extraordinary procedures such as local purchase, LOGCAP, or contracting at locations in the proximity of the theater. The ENCOM submits initial material forecasts using the civil-engineering support plan (CESP) data and BDPs.

Successful theater-construction execution depends on an adequate supply of materials as well as construction capability. Typically, during the early stages of a contingency operation, war-damage repair and construction of mission-essential facilities dominate engineer-construction activities. As the operational area matures, it requires that more substantial facilities and construction forces be made available. The ENCOM must ensure that adequate construction materials are forecasted to meet anticipated construction requirements. These materials must be flexible enough to meet a variety of requirements as engineers respond to changing conditions.

CONSTRUCTION-PLANNING CONSIDERATIONS

One of the primary responsibilities of the ENCOM staff is to forecast the types and quantities of engineer materials required for the theater. When an operation plan (OPLAN) is being executed, the CESP usually establishes the initial requirements during predeployment planning. Planning during the operation requires good intelligence concerning damaged roads, airfields or infrastructure facilities, inadequate facilities that require upgrading, and a list of additional facilities that are required. The Theater Construction Management System (TCMS) software package is designed to assist engineer planners in assessing theater facility requirements for deploying forces. The TCMS may also be used as a guide in determining material requirements for needed facilities. In some cases, existing facilities are modified to meet military requirements first, and then material requirements are estimated.

The ENCOM staff must also determine what materials are available from local sources. The materials may be from local manufacturers, commercial stockpiles, or HN government assets. Materials that are not locally available must either be procured out of theater or produced in theater by engineer units. Materials in the latter category include aggregate, concrete, construction water, asphalt, and lumber. A local procurement system must be established to expedite procuring local materials. Local procurement may be restricted in some theaters on prices set by the contracting officer's representative (COR) to avoid inflating the cost of construction materials in the HN.

CONSTRUCTION-DESIGN CONSIDERATIONS

Designers must consider the availability of construction materials when designing projects for the AO. Many designs may not be practical because of logistics considerations. For example, although AFCS and TCMS designs are adjusted for various climates (such as temperate, desert, tropic, and arctic), they may have to be modified to use unique local building materials and practices.

Military designers must know about local construction standards and materials commonly used in the region. Designs must include using local materials and be flexible about using substitute materials. This is particularly important when designing structures in contingency theaters. Many facilities are turned over to local authorities, and their operating and maintenance capabilities during long-term use must be considered.

The construction standard for an operational area is one of the following:

- Initial standard (up to 6 months expected use).

- Temporary standard (up to 24 months expected use). Since the design life is short, only essential utilities are provided. This also reduces engineer material requirements.

CONTRACTOR SUPPORT

The USACE or NAVFAC construction contract-management organization provides control of contract work. In a forward-presence theater, personnel staffing an existing USACE organization in that theater (such as the US Army Engineer District–Europe in Central Europe or the US Army Engineer Far East District in Korea) provide USACE support. In a contingency theater, the CINC, ASCC, and USACE for those countries that have not already had a CCA assigned will determine this support. For more information on this subject, see Chapter 4.

BASE DEVELOPMENT

Base-development planning is an ongoing process. The theater BDP results from concurrent planning by the CINC's staff and the service component staff considering strategic plans and resources. The ENCOM staff is responsible for the more detailed planning for each base. In peacetime, the CINC develops contingency plans for various scenarios. Logistics-support planning is general in nature and is only done to the extent necessary to identify resource requirements and assess OPLAN supportability.

In a wartime environment, strategic changes may cause a shift in theater objectives to a new AO. This, in turn, generates a requirement for new bases and/or major construction projects at existing bases in the new AO. Under these circumstances, base-development planning initially is more general in support of the development of COAs. The ENCOM then adds details to support the selected COA. It can use the AFCS or the TCMS to help determine the engineer force structure required to execute the BDP. In developing a time-phased plan for constructing the needed facilities, the ENCOM considers the–

- Construction capabilities of the HN.
- Availability of contractors.
- Availability of construction materials from HN sources.
- Availability of adequate port facilities early in base development to provide reception facilities for equipment and materials required to execute the plan. This may require early development of LOTS operations sites and may involve dredging ship channels to provide access to ocean-going vessels. Other specialized engineer capabilities like well drilling or diving detachments may also be necessary early in the base-development process. In any theater, base development is an important initial consideration. Force bed down is a substantial sustainment function in all theaters. Whether using existing facilities or temporarily constructed base camps, the operating-base development from an austere to a developed environment requires integrated planning from operators through logisticians.

  The ENCOM has overall responsibility for base development. The ENCOM staff, in coordination with the ASCC staff, identifies general locations for major facilities and tasks the engineer brigade or the engineer group to do the detailed planning and the facility siting. Base-development planning is normally not performed below the engineer-group level.

The engineer group or engineer brigade staff reconnoiters the proposed sites and develops plans and specifications in close coordination with the major logistics commands that use the facilities. The staff forwards these designs through the engineer brigade to the ENCOM for approval and incorporation into the overall theater BDP.

The ENCOM develops a time-phased BDP considering the facilities needed and the construction assets and construction materials available.

REAL ESTATE PLANNING AND ACQUISITION

The USACE Fwd element provides technical real estate guidance and advice to the CINC. It recommends real estate policies and operational procedures. It acquires, manages, disposes of, administers payment for rent and damages of, handles claims for, and prepares records and reports for real estate used within the theater. The theater element also exercises staff supervision over real estate operations of subordinate Army commands and provides real estate support to other US services.

Real estate planning must be initiated in the preparatory phases of a campaign by a planning group, which includes the USACE Fwd and representatives of all service commanders. The ASCC engineer participates in all planning activities. Besides plans for real estate operations during hostilities, real estate requirements for the occupation period after hostilities cease should be considered.

US forces acquire the real estate that they need by seizure or requisition and without formal documentation. They resort to seizure only when an urgent military situation arises and only with the approval of the commander who is responsible for that area. HN property may be occupied without documentation to the extent that tactical operations dictate and according to US/HN agreements. Normally, property is obtained through requisition, which involves a demand on the owner of the property or the owner's representative. No rent or other compensation is paid for requisitioned or seized real estate in a CZ or for damages resulting from acts of war or from ordinary military wear and tear.

Outside the active CZ, real estate is normally acquired by lease or HN agreements, and all transactions are documented thoroughly under the applicable provisions of theater directives. Large tracts of real estate are required for ports, staging areas, training and maneuver areas, leave centers, supply depots, and HQ installations. Some of this property may be highly developed and may have considerable value to the civilian population. Procedures must be followed to provide the property required while ensuring that the legal rights of owners are protected.

OPERATION, REPAIR, AND MAINTENANCE OF FACILITIES AND UTILITIES

Electrical power may be available from commercial sources in a mature theater. Power-generation capability, however, is required in most contingency theaters where commercial power is unreliable. Distribution systems are required, and adequate engineer units must be provided to do the necessary work. Standby power is required for critical facilities served with commercial power. Potable-water supply and waste-water collection systems require maintenance at most COMMZ installations and bases. The HN may provide the water and operate sewage treatment facilities, but RPMA assets are required to

maintain the utilities systems on bases and installations in the COMMZ to repair limited war damages. Austere water and sanitary facilities are used for troop bases constructed in a contingency operation.

The operation, maintenance, or repair of tactical generators is not a RPMA function. Normally each ASG has an assigned unit that provides RPMA support to facilities located within the ASG's area of responsibility.

FIRE PREVENTION AND PROTECTION

Engineer fire-fighting units that support the TAACOM provide the fire protection that is not available from the HN's or the base facilities engineer's section. Fire-fighting assets are allocated based on the troop population and the size of storage areas.

REFUSE COLLECTION AND DISPOSAL

The TAACOM establishes sanitary landfills for its operational areas. It is also responsible for trash and refuse collection. An engineer utilities detachment supporting an ASG normally establishes and operates the landfill. In many areas, existing HN landfills are used; in other areas, contract landfills are available. The ASG may use local labor to operate landfills. Commanders must give special consideration to hazardous waste, particularly waste products generated by medical facilities and maintenance operations. Special considerations in disposing of hazardous waste could be a factor. US federal or HN environmental laws may require packaging and/or removal of these containers from the theater.

ENGINEER SUPPORT TO DEVELOPING THEATERS

Support for force-projection/-contingency operations in undeveloped theaters may or may not involve combined-arms operations but may involve creating a sustainment base where none usually exists. HNS usually is not available; if it is present, it is normally limited. Additionally, the existing infrastructure may not support the needs of CS or CSS units.

Planners must identify general-engineering support requirements and corresponding engineer forces early when planning contingency operations. While forces participating in the force-projection/-contingency operation may be corps level and below, the majority of construction-engineer units are located in operational-level engineer organizations. Tailoring an engineer force from a mixture of multiechelon units will probably be the norm for most contingency operations.

The contingency engineer force may be built around an engineer brigade or a group HQ. Support such as construction contracting, construction Class IV supply, and real estate teams is provided from ENCOM and USACE modular cells to meet theater operational-level engineering requirements. The senior operational-level engineer HQ should be consulted during the task-organization planning because of its familiarity with operational-level engineer units.

Developing or immature theaters present many of the same problems as contingency theaters present. Operational-level engineer units perform general-engineering tasks well before a contingency operation is established. As in a contingency theater, certain elements usually will be required from the operational level in the early stages of an operation. Normally, these elements are assigned to the senior

operational-level engineer HQ in theater.

Since the mission, logistics support, and geographic orientation of operational-level engineers differ from corps and divisional engineers, separate command structures are necessary. Until the engineer force grows to sufficient numbers to require separate command structures, the senior engineer HQ in theater, often a maneuver engineer HQ, may be augmented by ENCOM and USACE modular cells and deployable TDA units with responsibilities to plan and coordinate general-engineering support and RPMA.

ENGINEER SUPPORT TO MATURE THEATERS

Engineer support in a mature theater is provided on a mission or area basis according to the theater commander's priorities and construction policy. Engineer units at the operational level provide topographic support to the theater, general-engineering support to all US bases or base clusters in the COMMZ, and contract construction support. Operational-level engineers may be tasked to provide support to the combat area, a HN, or another allied military force.

Based on the theater commander's policies and priorities, the ENCOM commander organizes his forces to best support the Army and other services. The prioritized mission-type engineer-support concept favors less restrictive command relationships; therefore, operational-level engineer units are normally employed in GS or DS of customer units. OPCON or attached relationships may prevent the ENCOM from effectively managing the theater engineer resources.

AREA DAMAGE CONTROL

ADC is the measures taken before, during, and after hostile actions to reduce the probability of damage and minimize its effects. The rear-operations center (ROC) coordinates all engineer support of ADC with the supporting engineer group. It makes maximum use of any HN capabilities and coordinates all HNS through the civil-affairs team. Base and base-cluster commanders develop ADC plans in coordination with the ROC. Bases and base clusters usually have to rely on their own assets; however, engineer units may be used in critical situations, depending on the priority of their other work. Engineer units execute rear-area restoration missions according to the theater-construction priorities. Typical missions include power restoration and production, rubble clearance, removal of downed trees, and repair of critical war-damaged facilities and installations.

Engineer units develop SOPs that integrate engineer support into the ADC team composition. The number and size of the teams depend on the ROC ADC plan. The basic unit is an engineer squad equipped with squad tools, air compressors, dozers, and a crane or wrecker. From the squad, the team can be increased to platoon, company, or battalion size, depending on the situation. Principal missions involve clearing the LOC of rubble and debris, fighting fires and floods, salvaging equipment, rescuing people, and preparing sites for deliberate decontamination operations.

The ROC directly tasks emergency ADC missions to the engineer group. The engineer group prioritizes other ADC missions, to include preattack measures and any damage repair missions. Engineers coordinate with the ROC for military police and EOD support.

Engineer units may also be tasked to perform ADC missions in support of the Air Force. The engineer group receives emergency-repair requests. Emergency-repair requests beyond the capability of the engineer group are forwarded to the engineer brigade. When operating on the air base, the base civil engineer establishes mission priorities. See FMs 90-23, 5-104, and 5-116 for more information on ADC.

CHAPTER 6

Engineers in Close Combat

CONCEPT

Combat engineers are at the vanguard, and they are a combat-arms unit. When conducting combat operations in the close battle, they must be prepared to fight and employ their combat skills, using fire and maneuver to accomplish their engineer mission. On today's battlefield, the enemy can detect and engage engineers quickly, regardless of their location. Consequently, all engineers are organized, trained, and equipped to fight and destroy the enemy. Combat engineers' secondary mission is to reorganize into infantry units and fight as infantry. This chapter addresses aspects of engineers in close combat, organized to fight as engineers or as infantry.

FIGHTING AS ENGINEERS

PERSPECTIVE:

> The requirements to maintain the mobility of attacking forces have often required engineers to enter the close-combat area. In January 1944, the 235th Engineer Combat Battalion was supporting the attack on Mount Porchio, Italy. In the midst of the battle, engineers moved forward on the right flank of the attacking task force to eliminate two obstacles of blown bridges to enable armor to move forward in support of the infantry. These obstacles were overcome in the face of intense enemy small-arms, machine-gun, mortar, and artillery fire. Twice during the operation, it was necessary for the engineers to attack and drive the enemy from strongly fortified positions to clear routes for the armor. For this effort, the 235th received the Presidential Unit Citation.

Combat engineers are organized, trained, and equipped to engage in close combat to accomplish their engineer mission, which could be to¯

- Conduct a movement to contact (MTC) or attack, as a part of a maneuver formation in the movement, to accomplish the formation's mission.
- Assist the supported organization to defeat an unexpected attack.
- Protect a critical demolition target that must be kept passable until friendly forces are able to withdraw.

- Maintain security at a work site.
- Protect themselves in an assembly area or on the march. The enemy will attempt to kill combat engineers as well as infantry or armor forces. It is imperative that engineers are trained to be physically aggressive and tactically competent.

ENGINEER COMBAT ORGANIZATION

The 12B combat engineer is trained to accomplish the same basic tasks as the 11B infantryman. The combat engineer specializes in engineer-unique tasks, as the infantryman specializes in infantry-unique tasks. The difference is emphasis. Engineer squads and platoons are trained to move rapidly and fight violently, either by themselves or as a part of a combined-arms formation.

Mechanized

Mechanized combat-engineer squads are organized around the armored personnel carrier (APC) and are armed with an array of rifles, squad automatic rifles, grenade launchers, light and heavy machine guns, and antitank (AT) weapons. The squads carry an array of demolition materials, configured into satchel and combat demolition charges, and are able to attack rapidly and violently with demolitions as well as with fire. In the platoon, they carry a basic load of conventional mines sufficient to emplace a minefield quickly, which they can defend if necessary.

Wheeled

Wheeled combat engineers are organized and equipped much the same as mechanized combat engineers. The major difference is the squad carrier, which is a 5-ton dump truck. On dismounting, the squad and platoon are trained to function much like a dismounted infantry organization in accomplishing their engineer mission.

All engineer squad carriers, mechanized or wheeled, are hindered by trailers except when moving as a part of a combined-arms formation. The squad must drop its trailer before it can effectively maneuver or employ mounted fire and movement. A trailer allows a squad to carry the quantities of demolitions and mines that give it close-combat power.

Light

Light engineers move on foot, carrying critical tools and equipment as well as demolition materials. As squads or platoons, light engineers move as a part of the light-infantry formation. Capable of using fire and movement techniques, they also contribute demolition and fire to the close-combat fight.

Heavy and Topographic

Combat (heavy) and topographic engineer units are armed primarily with rifles, with a limited number of crew-served weapons. They are not organized to move within combined-arms formations or to apply fire and maneuver. They are capable of engaging in close combat with fire and movement.

ENGINEER COMBAT CAPABILITIES

During offensive operations, combat-engineer units are task-organized with maneuver units and are integrated into the combined-arms formation. The engineer unit is designed to provide demolition and breaching capabilities to the combined-arms team. The engineer unit also can employ direct-fire weapons systems to aid in employing demolitions and breaching assets. Regardless of the mission, armored engineer vehicles are combat vehicles and provide a significant contribution to the combat power of the entire formation. To accomplish the mission, engineers will fire and move under the direction of the formation commander, as necessary, using demolition skills where appropriate.

When involved in an assault, engineers will fight dismounted on the objective, but they will be focused on breaching the close-in protective obstacles as well as demolition tasks against positions and dug-in vehicles. Demolition charges produce significant shock-and-concussion effects on defenders, as well as destroying critical positions, munitions, and combat vehicles.

Fire and movement techniques are based on rifle, automatic rifle, and grenadier-covering fire, allowing the placement of demolition charges to within striking range. The combat-engineer vehicle (CEV) in heavy divisions is also used in the assault. With its demolition gun, machine guns, and dozer blade, the CEV is extremely effective in close combat during the final stages of overrunning an objective.

Combat engineers employed on reserve demolition targets in the defense mainly execute the technical procedures necessary to ensure target destruction. However, the engineer demolition party responds to enemy contact. They assist the demolition guard in securing the target by holding it open or gaining time to ensure that it is destroyed. The engineer force may assist in target defense by installing antipersonnel (AP)/AT mines to support the defensive scheme.

Engineer units engaged in emplacing obstacle systems provide their own local security. They will employ close-combat techniques against attackers to the limit of their capability to ensure that the obstacle system is completed. Construction and topographic engineers also provide their own local security. In rear operations, they participate in base-cluster defense. They install local protective obstacles and fight from perimeter defensive positions. They also form reaction forces that can expel or destroy the enemy forces that penetrate a base cluster.

FIGHTING AS INFANTRY

PERSPECTIVE:

> The 1111th Engineer Combat Group ordered Company C, 51st Engineer Combat Battalion, to Trois Ponts to defend the town from German attack. Under the leadership of Major "Bull" Yates, the battalion executive officer, it defended against German tanks until relieved by the 505th Parachute Infantry Regiment. The airborne troops took up positions across the river, but were surrounded. The engineers had to provide covering fire to extricate them. After holding Trois Ponts for five days, Yates and his men withdrew during the evening of 21 December.

Historically, engineer units have performed their secondary mission, which still exists for combat-engineer units. While engineers fight continually as engineers, employing them as infantry

requires serious considerations.

EMPLOYMENT CONSIDERATIONS

Any commander who owns engineers in a command relationship has the authority to employ them as infantry, unless otherwise prohibited. A commander must carefully weigh the gain in infantry strength against the loss of engineer support. Engineers provide far more combat power in their primary mission than when configured as infantry. Stopping the engineer work may reduce the combat power of a commander's entire force. Because of the long-term impact, a commander must notify the next higher HQ when he employs engineers as infantry. A commander must carefully analyze infantry and engineer demands before deciding to employ an engineer unit as infantry.

An immediate requirement for infantry does not require reorganization; engineers are simply committed to the fight. Reorganization occurs when time allows moving unneeded engineer elements and equipment from the battle area and augmenting the engineer structure with additional capabilities. A commander normally considers reorganizing when he forecasts a shortage of infantry before a future operation or phase of an operation. He makes a decision after weighing METT-T factors and determining an acceptable risk level.

Division Level

Generally, division engineer battalions are task-organized throughout the division's area and are closely integrated with the other maneuver arms. Engineers fight and conduct their operations in this configuration. Engineers in a combat vehicle or dismounted formation (with satchel charges or rifle fire) fight, as required, under the formation commander. Engineers who prepare defenses fight from those positions alongside the defenders, if attacked. Division engineers use their close-combat skills as infantry, in an emergency, while performing their engineer mission.

Corps Level

Corps combat-engineer battalions working in either the division's or the corps's rear may be employed easiest as a separate infantry force. These units frequently work under the control of their battalion HQ and are not dispersed and integrated into other formations. They are also well located to move forward and join the force in contact, form a reserve, or prepare and occupy blocking positions. The commander directing this employment should provide early warning to allow the unit time to assemble, reorganize, and prepare before commitment. Immediate liaison must be provided from the engineer unit to the gaining maneuver command to facilitate planning and integration. This generally requires about 24 hours to accomplish, unless the unit has previously prepared for a similar mission.

When an engineer unit is employed as infantry, one major consideration for the commander is to store engineer equipment, such as bulldozers, bucket loaders, and road graders in tactical assembly areas. Equipment not used in the infantry role may be attached to other units for C2 purposes or to accomplish other engineer tasks. This is METT-T driven and generally based on the overall concept of the operation.

The commander directing the employment should augment the engineer unit with air-defense and fire-support teams. The unit should also be augmented with heavy AT weapons teams, mortar teams, and additional medical personnel, if available.

ORGANIC COMBAT POWER

Commanders with the authority to employ engineers as infantry must be aware of differences in combat power between engineer and infantry units. Combat-engineer units provide the following:

Engineer Platoon (Mechanized)

Organized as mechanized infantry, the platoon consists of four APCs carrying one HQ and three rifle squads. Each squad has a squad leader, carrier team, and dismounted team.

Engineer Company (Mechanized)

The forward elements of a reorganized engineer company consist of the company HQ, two rifle platoons, and an assault-and-obstacle platoon. Engineer equipment not needed for the infantry mission will be further task-organized to support the maneuver mission or temporarily positioned near the brigade support area (BSA).

Engineer Battalion (Mechanized)

The forward elements of the battalion consist of the battalion HQ and three rifle companies. The mechanized battalion can operate a tactical command post (TAC) and a main CP. The battalion commander has his own combat vehicle. The wheeled battalion normally establishes a consolidated HQ. The battalion establishes combat and field trains. It may keep its unique engineer equipment in an equipment park, near its field trains, or further to the rear.

Engineer Platoon (Light)

Organized as infantry, the platoon consists of one HQ and three rifle squads. Each squad has a squad leader and two fire teams.

Engineer Company (Light)

The company consists of one HQ and two infantry platoons. There are no rear elements.

Engineer Battalion (Light)

The battalion contains one small HQ and three rifle companies. The rifle strength of the light engineer battalion is low, as it contains only six rifle platoons.

UNIT CAPABILITIES

Engineer units employed as infantry do not have the same capabilities as conventional infantry units. Squad and platoon levels do not have a problem with this, as they normally operate the same as infantry organizations and have the same basic weapons.

The engineer company can effectively control other arms as a company/team because it normally works closely with them. The company, however, seldom maneuvers alone and is better suited to train for

defensive operations.

To be fully effective at the battalion level, engineer units need to be augmented with heavy AT weapons and mortars, as well as the normal CS provided to any infantry unit. Engineer battalions rarely maneuver as battalions, so their training makes them most effective in a defensive role, when employed as infantry.

Employing engineers as infantry will probably occur when the force's reserve has been committed, and it must be reinforced. The engineer reserve force can be used in two ways: as a reinforcing force for units in contact or as a blocking force to block an attack or counterattack. It can accomplish this by building and occupying a strongpoint. Other uses of an engineer reserve force include¯

- Augmenting an armor battalion with infantry to build a TF.
- Augmenting an infantry battalion with an additional company.
- Operating separately in an economy-of-force role or as a part of a brigade defense.
- Providing air-assault forces for seizing critical terrain.

CHAPTER 7

Tactical Planning

THE ENGINEER MEMBER OF THE COMBINED-ARMS TEAM

A staff provides a commander with the resources needed to win wars, campaigns, and battles. Each member of a maneuver force's battle staff provides a specific battlefield function or operating system. The staffs plan, integrate, and synchronize all the force's capabilities against the enemy to achieve the desired effects and outcome the commander expects.

Each maneuver-force echelon from corps down to battalion/TF level has an engineer officer to integrate engineers into the combined-arms fight. For some echelons, the engineer is solely a staff officer. Usually, the engineer is an engineer unit commander/leader and a staff officer. In either case, the engineer is a special staff officer who is a member of the echelon's battle staff. He plays an integral part in developing plans and orders. Engineers work with all members of the battle staff and must understand their capabilities to effectively integrate and synchronize the M/S Battlefield Operating System (BOS).

PERSPECTIVE:

Final report from the chief engineer, European theater, World War II, observations and lessons learned.

1. It is exceedingly important at an early date in planning to establish all possible basic planning factors so that quick and reasonably accurate estimates can be given while changes in the operational plan are still under consideration.

2. Accuracy in estimates can be carried to an extreme. It leads to self-deception to express requirements in fractional figures when the basic factors and assumptions do not warrant such accuracy.

3. Because of the time required in the procurement of supplies from whatever sources they are obtained in their movement to the point of use, it is absolutely essential that requirements be computed at the earliest possible date. The first estimates may have to be quite rough and refinements may have to be made as the operational plans become firmer, but material requirements of some sort on the best available data must be set up early.

4. When the final results of planning have been made, someone, preferably the chief engineer, must survey the answers as a whole and decide whether or not the composite plan seems logical and sensible.

THE PLANNING PROCESS

The tactical decision-making process is a systematic approach to formulating tactical plans. The processes used are troop-leading procedures (TLPs), the estimate of the situation, METT-T, and IPB. These processes are interrelated. They are accomplished based on the amount of time and resources available. The following paragraphs discuss—

- Conducting TLPs.
- Commander and staff actions.
- Integrating the estimate of the situation, METT-T, and IPB into TLPs. TLPs, although continuous, are not cut-and-dried processes. There are no distinct start and stop points. The eight steps are not always performed sequentially; some can occur simultaneously. For example, the less time a unit has, the more it must adjust or abbreviate the TLPs.

  Collecting, analyzing, and distributing information is a continuous staff requirement. Information that an engineer staff section analyzes is exchanged with other staff sections and used to update situation statuses. To successfully execute the mission, the engineer staff must focus on the information needed by the maneuver and the engineer commanders. They will conduct all of the above procedures, to include the engineer estimate, as the method for supporting the tactical decision-making process.

  The engineer estimate is a logical thought process that supplements the estimate of the situation and the orders process. (See Appendix B for an example of the engineer estimate.) It is continuously refined and conducted concurrently with the maneuver unit. The engineer estimate has a specific purpose. It—
- Allows for integrating and synchronizing the M/S BOS.
- Drives the coordination between the engineer, commander, and primary staff.
- Drives the development of engineer plans, orders, and annexes. The tactical decision-making process is the planning framework for the combined-arms staff. The engineer must be familiar with the process; moreover, he must be familiar with how he participates and coordinates with the combined-arms staff.

STEP 1. RECEIVE THE MISSION

TLPs begin with the receipt of a new mission. A unit normally learns of a new mission through a warning order (WO) from the higher HQ, followed later by an operation order (OPORD). A mission could also be announced in a fragmentary order (FRAGO) as a change to the current operation, or it can be deduced by the commander as a result of ongoing operations. A unit should begin planning as early as possible. The higher HQ should take no more than one-third of the available time it has to issue its order. Likewise, each successive unit has the same obligation to issue its order in a timely manner.

The engineer commander and staff will focus on several essential components of the basic order and

engineer annex. They are the¯

- Enemy situation.
- Mission paragraph.
- Task organization.
- Service-support paragraph.
- Engineer annex. From these components, the engineer commander and staff determine the¯
- Type of operation.
- Enemy and friendly situations.
- Assets available.
- Time available. As soon as the engineer commander learns of a new mission, he should issue an initial WO to subordinate units. The initial WO should inform them about the nature and timing of the new mission. The engineer staff will then convene and conduct the mission analysis. It is very likely that the engineer staff will conduct parallel planning during the estimate of the situation.

STEP 2. ISSUE A WO

The engineer commander should issue a WO to units immediately after the maneuver commander issues his planning guidance. The WO should be brief but contain enough information for the units to prepare for the mission. Additional WOs can be issued later to keep units informed and for parallel planning to occur. WOs normally do not have a specific format; however, some of the information that should be in a WO is as follows:

- Enemy and friendly situations (brief).
- Changes in task organization.
- Earliest time of the move.
- Nature and time of the operation.
- Time and place of the OPORD.
- Other specified tasks.

STEP 3. MAKE A TENTATIVE PLAN

The process that forms the basis for the entire operation is performed in this step. The time factor is a major influence on how the estimate of the situation is performed. The three tactical decision-making processes are deliberate, combat, and quick.

The three processes are highly influenced by the element of time. The most common process conducted is the combat decision-making process (CDMP). The CDMP facilitates the demands of the ongoing operation by matching the realities of the high-tempo battlefield where windows of opportunity for action are fleeting and tactical demands challenge the command continuously. The CDMP is used during operations when the command may be executing and planning up to three operations simultaneously. Normally in the CDMP, a single friendly COA is war-gamed against enemy COAs.

Mission Analysis

The first step of the command estimate process is the mission analysis. The combined-arms staff or engineer staff will present the maneuver/engineer commander with facts and assumptions that he will use for analyzing the mission and developing COAs. The information pertains to both friendly and enemy situations. The engineer staff officer assists the commander in developing facts and assumptions by participating in the IPB and conducting the engineer battlefield assessment (EBA).

The IPB centers on templating enemy forces, anticipating their capabilities, and predicting their intentions based on threat doctrinal norms and the order of battle. The engineer must understand the maneuver G2's/Intelligence Officer's (US Army) (S2's) doctrinal and situation template so that he can analyze threat engineer capabilities and the order of battle. The situation template becomes the foundation for the maneuver G2/S2 and engineer coordination. During threat evaluation and integration, the maneuver G2/S2 and the engineer must work together. For example, obstacle intelligence (OBSTINTEL) and templating are developed in concert with the S2's templating of a motorized rifle battalion's defense. The engineer S2 will use the situation template to further develop intelligence requirements (IR), priority intelligence requirements (PIR), and named areas of interest (NAIs) to support the event template and the reconnaissance and surveillance (R&S) plan. The engineer will ensure that OBSTINTEL collection is integrated into the R&S plan.

The engineer develops facts and assumptions and supports the IPB process through the EBA. He analyzes the terrain and weather and assesses the impact that they will have on military/engineer operations. He analyses the terrain using the following five military aspects of terrain:

- Observation and fields of fire.
- Cover and concealment.
- Obstacles.
- Key terrain.
- AAs. The function of the terrain analysis is to reduce the uncertainties regarding the effects of natural and man-made terrain on friendly and enemy operations.

  Analyzing the military aspects of the terrain is accomplished primarily through preparing the modified combined obstacle overlay (MCOO). The engineer S2 will assist the maneuver G2/S2 in developing the MCOO. It is the basic product of the battlefield-area evaluation, terrain analysis, and weather analysis phases of the IPB process. The MCOO is the graphic terrain analysis on which all other IPB products are based. A slope overlay (for example, TerraBase) can determine trafficability and intervisibility for intelligence collection, target acquisition, weapons capabilities, and obstacle integration within the AO. These products will be used for COA development and analysis.

  The second component of the EBA is to analyze the threat engineer mission and capabilities. The first step is to understand the enemy's mission and consider its doctrinal use of engineers. The engineer S2 uses the maneuver G2/S2's doctrinal and situation template to develop the threat engineer order of battle. He will further assess the enemy's M/CM/S capabilities and template its effort and location. In coordination with the S2, the engineer S3 will recommend IR/PIR, attempt to augment the reconnaissance effort, and monitor the collection to confirm or deny the situation template.

  In the defense, the engineer templates the enemy's—

- Mobility capabilities and location in its formation.
- Use of SCATMINEs.
- Engineers in the reconnaissance effort.
- High-value target (HVT) (bridging and breaching assets). In the offense, the engineer templates the enemy's
- Tactical- and protective-obstacle effort.
- Use of SCATMINEs.
- Survivability and fortification effort. The third component of the EBA is to evaluate friendly engineer capabilities and their impact on mission accomplishment. To perform this function, the engineer uses the information he developed in the first step (receive the mission). He evaluates the task organization to determine the engineer organization and assets available. He considers the possibility of additional support from the maneuver force and the engineer higher HQ. The engineer must also consider the availability of critical resources. After he determines the total assets available, he uses planning factors or known unit work rates to determine his capabilities.

  The engineer staff officer combines his analysis of the terrain and the enemy's and friendly's capabilities to form facts and assumptions about
- Likely enemy engineer effort and the most probable enemy COA.
- Critical friendly and enemy tactical events.
- Potential enemy vulnerabilities.
- The effect of these factors on the mission. The facts-and-assumptions process is lengthy, and the engineer must maintain his focus on the information required by the maneuver commander and his battle staff to make decisions. The EBA is a continuous process that is continually refined. Each time new information is collected, the engineer must evaluate the impact/effect on the mission and refine the facts and assumptions as necessary.

Higher Mission and Intent Analysis

When analyzing the mission, the OPORD should be studied in front of a map with the overlays posted. This will allow a better understanding of the terrain on which the operation will take place. It will allow implied tasks to be more readily identified. It is a good idea to list all identified tasks on paper. The list can be checked later to ensure that all tasks have been addressed in the plan. The following should be identified during the mission analysis:

- Specified tasks. These are the tasks stated in the OPORD. Specific tasks are found in paragraphs 2 and 3 of the OPORD; however, they could be found elsewhere in the OPORD. River-crossing operations, obstacle-control measures, and combined-arms breaching are examples of potential specified tasks.
- Implied tasks. These are the tasks not stated in the OPORD that must be accomplished to complete the overall mission or to satisfy any of the specified tasks. River-crossing, combined-arms breaching, and obstacle operations are typical implied tasks.
- Essential tasks. These tasks are taken from the list of specified and implied tasks that must be accomplished to satisfy the overall mission or to satisfy any of the specified tasks.
- Assets available. These are assets allocated in the task organization or discussed in organizations

for combat in paragraph 3 of the OPORD. More importantly, the relationship between the mission and the assets is critical to the engineer. The folding together of time, space, and assets is critical to the success of a mission. For example, the staff engineer must assess the capabilities of combat, CS, and CSS assets to plan a breaching operation and other requirements to support a transition to the defense.

- Limitations. These are restrictions placed on a commander specifying things that cannot be done and/or things that must be done. Constraints are specified tasks that limit freedom of action. Obstacle zones and belts are excellent examples of limitations because they limit the area in which tactical obstacles can be emplaced.
- Risk. The higher HQ might specify a risk that the commander is willing to accept to accomplish the mission (for example, an economy of force in a certain area).
- Time analysis. The element of time is not clearly identified for analysis in any of the staff estimates. However, time analysis must be an integral part of the mission analysis and must be conducted continuously until the mission is accomplished. Once the commander has an understanding of his mission and the time available, he must allocate the time for the various phases of the operation. This allocation is often done by reverse planning. Knowing the time to execute the operation, the commander must consider the amount of time needed for the unit to accomplish troop-leading tasks. The time analysis produces a schedule of activities that must occur (time line). Finally, as a part of the mission-analysis brief, the executive officer (XO) will recommend the time line for the operation.

Commander's Restated Mission and Planning Guidance

This may be the first time the maneuver or engineer commander is able to meet with his staff. The briefing will include the tasks identified and the restated mission that the staff recommends. The commander will approve or disapprove the restated mission and issue his planning guidance to the staff. The commander and his staff should develop a list of priorities to discuss at this briefing. This is the staff engineer's opportunity to raise any questions with the commander. The commander's planning guidance should consist of the following:

- Restated mission.
- Higher commanders' intents (two levels up).
- His own intent (required).
- COAs for his staff to consider.
- Time and place of decision brief (time line).
- PIR.
- Commander's critical-information requirements (CCIR).
- Effects desired on the enemy force.
- Risk assessment. The commander's guidance is the single most important element of the estimate process. His ability to state his vision for the mission will provide the staff with a defined focus required to develop and analyze COAs. The engineer commander must provide his guidance as it applies to vertical and horizontal planning. The engineer staff will focus primarily on identifying, integrating, and synchronizing tasks to support the engineer mission (vertical). The engineer staff will also focus their efforts on conducting the above, but they will concentrate on how the engineer

is integrated and synchronized in support of the maneuver unit's mission (horizontal).

Step 5 of the TLP is to conduct reconnaissance. However, the commander may decide to conduct his reconnaissance at this time instead of later. Reconnaissance missions given to the units could also be issued at this time.

COA Development

A COA is a possible plan open to the commander that would accomplish the mission. It is usually stated in broad terms with the details determined during war gaming. The engineer staff officers come prepared with their tools for planning. The EBA, produced by the engineer staff, provides a reference for their participation in the COA development and analysis. Depending on the time available and officers' experience, the G3/S3 will decide on their level of participation in developing COAs. The following are the steps involved in developing a COA:

- Analyze relative force ratios.
- Array initial forces.
- Identify critical events, enemy's and friendly's.
- Develop an initial scheme of maneuver
- Determine C2 means and control measures.
- Prepare COA statement(s) and sketch(s). At a minimum, the engineer ensures that the maneuver G3/S3 understands the engineer task organization and available combat power. He begins to develop his scheme of engineer operations to support the COAs. His initial scheme is a rough draft and is refined during the war-gaming process.

COA Analysis

An analysis identifies the best COA for recommendation to the commander. It can begin with the G3/S3 briefing the staff on each friendly COA. At this time, a quick analysis by the engineer might identify a COA that is not feasible in his area of responsibility; therefore it should be eliminated or modified immediately.

The combined-arms staff, led by the chief of staff or XO, will analyze (war-game) each friendly COA against enemy COAs. War gaming is a logical step-by-step process that relies heavily on tactical judgment and experience. The analysis process is action, reaction, and counteraction. The war-gaming technique used (AA, box, belt) is based on time and staff training. Detailed war gaming is designed to accomplish the following:

- Achieving the desired end state of a COA.
- Listing advantages and disadvantages.
- Assessing the feasibility of the COA.
- Completing the event template.
- Identifying requirements for CS and CSS.
- Synchronizing combat functions/critical events.
- Completing the synchronization matrix and decision support template (DST).

- Developing the engineer task organization.
- Developing the OPORD. Detailed war gaming focuses on the timing aspect of the operation. The friendly COA selected will be war-gamed in a deliberate fashion against the enemy's COAs. A myriad of tasks from the commitment of reserves, close air support (CAS), indirect fire, and the employment of family of scatterable mines (FASCAM) will be synchronized. Additional NAIs are identified and included in the event template. Targeted areas of interest (TAIs) and decision points are identified and annotated on the DST. The DST, also referred to as the revised operations overlay, is the result of detailed war gaming. (See FM 101-5 for more detail.)

  The engineer must be an active player. For example, he must war-game the timing aspects of situational obstacles, obscuring and suppressing for combined-arms breaching, and the positioning of forces and material for current and future operations. It is through detailed war gaming that the battlefield is truly synchronized. Understanding basic movement rates and other planning factors is paramount in war gaming.

  The fundamental role of a combined-arms staff is to synchronize and apply all the capabilities of the unit and contribute to the success of the mission. The staff must record the results of each war game on the synchronization matrix and DST. This will ensure that every member of the combined-arms team understands when and where they need to apply their capabilities to achieve the effects and outcome the commander expects.

  The maneuver G3/S3 will portray the friendly force while the G2/S2 will interpret the enemy situation template and anticipate enemy actions. The engineer must be ready to interject thoughts and identify critical events/tasks as they apply to his BOS. He identifies engineer tasks and determines if a task is feasible based on the assets available. Also, he must articulate the actions of threat engineers as the battle is played out. The war-gaming session must assess the COA's feasibility and capture issues, tasks, and actions that are discussed during the session. The information gathered will be used to further develop the event template and the synchronization matrix. The engineer uses this information to further develop his scheme of engineer operations.

COA Comparison

The fourth step in the command estimate process consists of comparing options and choosing a COA. The actual comparison may follow any technique that will allow a recommendation to be reached. An effective technique for comparing COAs is to use a comparison matrix. Each COA is compared to the others, using specific criteria. While comparing COAs, the engineer will determine which scheme of engineer operations best supports accomplishing the mission.

Recommendation/Decision

The staff recommends the best COA to the commander. Each COA is outlined, the advantages and disadvantages of each presented, and a recommendation made. The maneuver commander considers the staff recommendation presented by the G3/S3 and announces his decision and concept/intent. At this point, the engineer commander can issue another WO to the subunits with the updated information that the maneuver commander provided. This will better facilitate the planning for engineer subordinate units. The engineer staff officer makes his recommendation to the commander during the decision brief. The type and amount of detail that the engineer briefs depend on the needs and preferences of the individual

commander. In general, it covers the—

- Concept of engineer support.
- Engineer mission priorities.
- Critical engineer events/actions.
- Task-organization and command/support relationships.
- Obstacle overlay (including SCATMINE employment authority and concept for use by system type).
- Survivability estimate and priority.
- Critical tasks directed to subordinate units.
- Engineer's work time line. Other members of the battle staff brief information that the engineer provides during the estimate process. This is particularly true of the intelligence portion of the decision brief and the comparison of COAs. Once the commander makes his decision, the estimate provides the bulk of the information needed to prepare the maneuver force's OPLAN or OPORD.

STEP 4. INITIATE MOVEMENT

Movement can be started with a new WO, FRAGO, or a movement order. Units may have to reposition to start the operation on time. Movement of subordinate units may be necessary to change task organization. Some movement, especially by reconnaissance units, may be necessary immediately after receiving the WO from the higher HQ. If there is enough time to issue the OPORD before any movement begins, the movement instructions can be included in the OPORD. Often movement may have to occur simultaneously with planning.

STEP 5. CONDUCT RECONNAISSANCE

Reconnaissance should be conducted whenever possible. The situation, especially time available, dictates the type and quality of reconnaissance. To best use available time, leaders should do an initial map reconnaissance to find routes and locations to reconnoiter before departing. For best results, map reconnaissance begins immediately on receipt of the higher HQ WO; it should continue through mission accomplishment. Reconnaissance requires a combined-arms effort, and the combat engineer can be a key player. The fundamental imperative is to train the reconnaissance force.

STEP 6. COMPLETE THE PLAN

Upon completing the detailed war game and decision brief, the staff quickly prepares the plan/order. The tasks identified through the war-gaming sessions are used in preparing the plan/order. Specific engineer tasks and instructions that involve maneuver units should be written in paragraph 3 of the OPORD. All other tasks related to the engineer scheme are included in the engineer order and annex. Multiple copies of the plan/order must be made, and overlays must be accurately copied.

STEP 7. ISSUE THE ORDER

An OPORD is a directive issued by a commander to subordinate commanders for a coordinated execution of an operation. A FRAGO is an abbreviated OPORD used to convey changes to an OPORD, as required by the situation. The order should be issued at the time and place stated in the WO. The most secure means available should be used. As a minimum, an overlay order, including an execution matrix, should be issued to subordinates.

The engineer should brief the engineer portion of the maneuver order. He will brief significant engineer tasks as they relate to the scheme of maneuver. This is his only opportunity to brief subordinate maneuver commanders on the scheme of engineer operations. He ensures that they understand the task organization and specific instructions to subordinate units.

STEP 8. SUPERVISE

Once orders are issued, the engineer commander and staff supervise combat preparation and execution. Rehearsals, precombat checks and inspections, intelligence updates, and battle tracking are checked and monitored.

Reports are submitted according to the unit's tactical SOP. Battle maps and status charts are accurately maintained. This cannot be overemphasized. The reporting scheme that the commander establishes must be efficient. Too many reports will overload the system. Reports should be focused on what the commander needs to make critical decisions.

The planning process is a systematic approach to formulating plans and orders. The TLPs, estimate of the situation, METT-T, and IPB are the processes used. They are interrelated and accomplished based on the amount of time and resources available.

PLANS AND ORDERS

Once the commander decides on a COA, the staff immediately organizes and compiles its estimates and produces the OPORD. An OPORD is a directive that the commander issues to subordinate commanders for a coordinated execution of an operation.

MANEUVER FORCE OPORD/OPLAN

The engineer assists the rest of the staff to produce the order or plan. The primary concerns follow:

Task Organization

The OPORD title, and/or a separate annex, depicts the task organization. The engineer staff officer lists the engineer units under the proper control HQ, with the correct command or support relationships.

Engineer Concept

The OPORD, paragraph 3, Execution, subparagraph Concept, describes how the commander sees the

operation from start to finish. This usually includes a brief concept for the engineers. The engineer concept clearly states priorities to maneuver units or tasks. It avoids overly broad generalities such as a priority listing of M/CM/S headings. Instead, the concept gives the commander's specific priorities for the operation. Sample priorities could be that TF A shifts to TF B on seizure of Objective C or priority to Obstacle Belt A1A then to Obstacle Belt A2A.

SCATMINE Concept

The engineer, G3/S3, and fire-support officer (FSO) form the SCATMINE concept, as part of the engineer concept, while they develop and analyze the COAs. The SCATMINE concept briefly states how the commander intends to use SCATMINEs, by system type. Also, it gives control measures to facilitate future maneuvers and includes approval authority for employing short and long self-destruct mines. Other parts of the OPORD (particularly the engineer annex and fire-support annex) contain the detailed plans of implementing the SCATMINE concept of operation.

Engineer-Unit Subparagraph

Paragraph 3 of the OPORD includes taskings to subordinate units. The engineer-unit subparagraph assigns engineer tasks identified throughout the estimate process. When the OPORD title does not clearly state the engineer task organization, the engineer-unit subparagraph should.

Service Support

Paragraph 4 includes required materiel or services to support the engineer units and their missions. At division level and above, service-support information often appears in a separate annex.

Engineer Annex

This annex contains information relevant to engineer operations but not required for executing the other aspects of the plan. It helps to keep the basic order short. It also consolidates all information that units involved in engineer operations require. The maneuver commander directs it as part of his order to the entire force, not just to engineer units.

Orders at corps and division levels generally contain a written engineer annex using the five-paragraph format shown in FM 101-5. Below division level, the engineer annex can use the five-paragraph format, or it can be a combination of an overlay, obstacle list, execution matrix, or a verbal briefing.

ENGINEER UNIT OPORD/OPLAN

Engineers often begin work on tasks for a maneuver force before the tactical plan is complete. The engineer commander issues a WO, as soon as possible, so that his subordinates can do this. He moves units and materials in advance of specific, detailed instructions from the maneuver commander. Once the maneuver plan is ready, the engineer commander completes his plan quickly and issues the order. He uses one-third or less of the available planning time at his level and leaves the remaining two-thirds of it for subordinates to do their planning.

The engineer unit commander issues his own order to the unit to perform the mission that the controlling

HQ assigns. The commander's own tactical estimate provides most of the information needed for the order. The order explains the plan clearly, so that subordinate leaders can make decisions and implement the commander's intent, even when communications fail. Appendix C gives the format and explains the contents of the engineer unit order.

CHAPTER 8

Offense

OPERATIONS IN DEPTH

Engineer support in offensive operations occurs throughout the depth of the battlefield. Engineers provide continuous and coordinated support to deep, close, and rear operations.

Engineers plan obstacles that forces can emplace in the enemy's rear. Knowledge of the terrain can identify locations where friendly forces can stop enemy reinforcements.

Engineer reconnaissance identifies areas where friendly forces cannot move or where the movement requires the engineer effort. Attacking forces task-organize engineer units to provide mobility support to the main and supporting attacks and to the reserves. Engineers provide countermobility support to secure vulnerable flanks.

Engineers sustain the momentum of the offense by establishing and maintaining LOC and by providing force protection to C2 and CSS elements.

PERSPECTIVE:

In the VII Corps's initial breach of the Siegfried Line in September 1944, the task force conducting the operation consisted of a tank battalion, two infantry companies, and two platoons of engineers. A preliminary reconnaissance succeeded in identifying the numbers and types of obstacles to be overcome. During the assault, the force reached the line without difficulty, but came under intense mortar and machine-gun fire when among the dragon teeth. Suppressive fire from the tanks and other heavy weapons relieved some of this fire. The engineers were able to remove one roadblock by hand but were not able to remove the other until after nightfall. The final roadblock was eliminated with demolition charges on the major supporting steel beams and gates. A tank dozer quickly filled in a road crater and a tank ditch in the obstacle belt. Of the two engineer platoons in the initial operations, one man was killed and sixteen were wounded.

ENGINEER FOCUS IN THE OFFENSE

Engineer commanders and planners focus on sustaining the offense's momentum. Attacking forces must retain the initiative. Engineers, with breaching assets organic to the maneuver unit, provide the mobility capability to overcome obstacles. Combat engineers are forward in the attack formation as an integral part of the combined-arms team. They respond rapidly to conduct breaching operations and other mobility tasks. Additional mobility capability, integrated throughout the formation, will improve movement avenues. This provides the flexibility needed to respond to changing tactical situations. Follow-on engineers develop and maintain multiple routes to build combat power and logistics.

Units must carefully plan countermobility operations. The maneuver commander must use obstacles discreetly to shape the battlefield and concentrate combat power. These obstacles must not inhibit friendly movement. Also, the commander must conserve manpower, haul, and obstacle resources. Engineers plan obstacles, especially SCATMINEs, to disrupt enemy counterattacks.

Engineers enhance the survivability of forces, in part, by maintaining the tempo of the offense. Engineer mobility efforts and counterobstacle operations assist in synchronizing the offense by preventing a loss of momentum or an incomplete commitment of forces. Engineer digging assets provide survivability to key systems or units during operational halts or when transitioning to the defense. Engineer assets, because they have distinct appearances and uses, can assist in deception operations. For example, moving bridge trucks to various river-crossing sites can deceive the enemy about the actual crossing location.

The ability to mass combat power and conduct continuous offensive operations for an extended time is key to the success of the offense. General-engineering operations focus on the requirements to sustain operations and ensure that commanders can commit follow-on forces decisively. Besides maintaining MSRs, engineers-

- Develop or improve transportation nodes (airfields, ports, railroad terminals).
- Manage real estate.
- Provide and operate large-scale power-generation capabilities.
- Find and drill for water.
- Perform vertical and horizontal construction in support of the theater. Topographic operations offset the advantage the enemy has in occupying the terrain. The commander can better command and control by quickly disseminating accurate topographic information. This information can identify the best approach routes for friendly forces and help template the enemy's defensive positions. The engineer's terrain analysis and its effects on maneuvers assist the commander in establishing the proper tempo of the offense.

PLANNING ENGINEER OPERATIONS IN THE OFFENSE

Planning engineer support for offensive operations follows the tactical-planning process. Planning considerations specific to the offense include-

- A highly mobile engineer force, well forward and integrated into maneuver formations, that is

critical to maintaining the momentum of the attack.

- Engineers or maneuver units that must report and mark lanes or bypasses through or around obstacles.
- Special considerations for engineer equipment, such as replacement bridges for armored launchers, follow-on tactical bridging, lift capability for mine-clearing line charge (MICLIC) reloading, and lane-marking materials to replenish marking systems.
- Combined-arms obstacle-breaching rehearsals to ensure that all units involved are synchronized.
- General-engineering requirements that will increase during offensive combat, since LOC will lengthen.
- An on-call, rapid-mining and rapid-obstacle emplacement capability that is essential for flank security.
- Commanders at brigade and TF levels who will configure engineers to emplace obstacles rapidly to protect attacking forces from enemy counterattacks once on the objective.
- Planning for a transition to the defense. This is essential because of the long lead time needed to obtain and move engineer Class IV and Class V materials (such as mines).

MISSION, ENEMY, TERRAIN, TROOPS, AND TIME AVAILABLE

The maneuver commander must consider METT-T factors when planning engineer support for offensive operations. Examples are as follows:

- Mission. Some offensive missions require significant engineer efforts, such as a river crossing, a deliberate breach of a complex obstacle, an assault of a fortified position, or an attack into urban terrain.
- Enemy. The engineer must be an expert on the enemy engineer's strengths, activities, equipment, capabilities, and probable COAs. Friendly engineers must know what the enemy can do so they can overcome its capabilities.
- Terrain. The engineer is the terrain expert. He must work closely with the S2 to determine advantages and disadvantages the terrain gives the attacking force. The staff must consider the effects of terrain when analyzing COAs.
- Troops. The commander must consider the number and type of engineers available, along with the engineer-related equipment (such as breaching equipment) and how to best task-organize to accomplish the mission.
- Time Available. The need to conduct an operation quickly may affect how the engineers execute it or how they organize. The time available also may affect how the unit conducts rehearsals.

PERSPECTIVE:

The 1st Infantry Division's attack at Cantigny was the first American offensive action in World War I. The purpose of the attack was to seize the high ground on which the small village stood. The division was to use this ground as a defensive position in anticipating a continuation of the 1918 German Offensive. The engineers supporting the assault force rehearsed the assault for several days before the actual attack. In addition, they constructed aid stations, established forward supply dumps, and built command and observation posts.

Much of this was done under shellfire, which inflicted 20 percent casualties in the direct support engineer company. When the infantry seized the objective, the engineers immediately began work on fortified fighting positions. Although returned to the reserve when this work was done, they were called forward to act as infantry to strengthen the line. Engineers continued to work on emplacements, stringing wire at exposed positions and searching for timber and other construction material to shore up bunkers against the German's massive artillery fires.

TASK ORGANIZATION

The commander must carefully consider how to task-organize engineers. In the offense, engineers must be well forward in the attack formation and responsive to the maneuver units. They must make quick transitions to support all phases. A steady relationship between engineer and maneuver units enhances agility and flexibility. Engineers must link up with their maneuver unit well in advance of an operation. As engineers travel to where the maneuver force needs them, their ability to react to a situation could depend on their positioning before the battle. During an offensive mission, the commander should keep changes to the engineer task organization to a minimum. Once the battle starts, there normally is not time to restructure the engineer organization or move them across the battlefield.

The engineer commander and staff should determine which engineer scheme of operations best supports the maneuver commander's intent. The engineer's main effort may not be the same as the maneuver commander's. However, the engineer's main effort may be a combat multiplier elsewhere and help ensure the success of the commander's overall intent. Often, the engineer's main effort ensures the success of a maneuver's supporting effort. The engineer unit may weigh the main effort through the presence of the commander or the senior staff or logistically through MICLIC or Volcano mine reloads. The designated priorities of engineer support should identify the principal focus (M/CM/S) and a point of application. For example, the priority may be mobility along a certain axis of advance.

There are other considerations for task organization. The engineer must recommend the best command or support relationship to the maneuver commander. The engineer staff must anticipate future missions and organize appropriately.

PREPARATION

When preparing for combat, engineer involvement begins early with a staff engineer supporting the operation's planner at all levels. Engineer forces align themselves according to initial task organization and position themselves to rapidly develop routes through obstacle systems or conduct covert breaching before initiating the action. Engineer units, like maneuver units, must have adequate time to conduct their TLP. This involves preparing and issuing orders, conducting precombat checks and inspections, and coordinating logisticsresupply. Rehearsals are very important in offensive operations. Coordination between moving units on the battlefield is difficult. Engineers must know what they have to do. Commanders and staffs identify critical operations involving engineer support to the plan and rehearsals as part of the preparation for combat.

ENGINEERS IN THE OFFENSE

Besides terrain, engineers are the experts on obstacle siting and employment. They provide the maneuver commander with an engineer analysis of the terrain. The analysis focuses on trafficability, and it identifies likely enemy obstacle locations as part of the IPB process. To find weaknesses in the enemy's defense, a thorough EBA is essential. Accurately templating the obstacle system facilitates attacks through gaps and against flanks. This avoids the enemy's strength. The template also provides the basis for the engineer reconnaissance plan.

PERSPECTIVE:

With his forces approaching Mexico City, General Winfield Scott began to develop his final attack plan on the city. Two of his engineers, Robert E. Lee and Pierre G. T. Beauregard, conducted a reconnaissance of a lava field known as the Pedregal. The two convinced Scott that a road could be built through the lava field, allowing artillery to move forward and enfilade a principal defensive position of the Mexicans. Scott agreed and Lee began supervising the construction. Mexican forces attempted to stop the construction and precipitated the Battle of Contreras. A short time later, American forces, moving along a path found by engineers, flanked the Mexicans at Churubusco and routed them. Years later, General Ulysses S. Grant remembered, "This affair, like that of Cerro Gordo, was an engagement in which the officers of the Engineer Corps won special distinction. In fact, in both cases, tasks which seemed difficult at first sight were made easier for the troops that had to execute them than they would have been on an ordinary field."

RECONNAISSANCE

Reconnaissance is vital to verify the accuracy of the assessment. Detailed information on existing (natural or cultural) and reinforcing obstacles identifies obstacle limits. It also determines whether a bypass or an in-stride breach is an option, which will require reconnaissance from all elements on the battlefield. Engineers identify specific reconnaissance requirements and augment patrols and scouts to identify obstacle characteristics. The maneuver unit must integrate engineer reconnaissance into their reconnaissance plan.

During the attack, engineer reconnaissance teams and engineer units provide continuous surveillance along the routes of advance. They pay special attention to the MSR, bypassed obstacles, minefields, and engineer materials in their assigned areas.

MOVEMENT TO CONTACT

A MTC is conducted to gain or reestablish contact with the enemy. It is used to develop the situation early to provide an advantage before decisive engagement. The brigade conducts a MTC as part of a larger formation. The commander concentrates the engineers at the front of the MTC formation. Engineers with the maneuver force allow it to move through undefended obstacles and restrictions and to fight through defended obstacles. Engineers must conduct armored earth moving, rapid minefield breaching, and assault bridging.

The engineer force trains in reconnaissance. Engineers identify the best routes for forward movement. They also identify lateral branch routes to provide the commander flexibility as he develops the situation. Units conducting a MTC must train in breaching obstacles in stride. They should expend only the minimum effort needed to complete the assault breach. Follow-on engineers are responsible for widening lanes and clearing obstacles.

Engineers with the advance guard assist rapid movement, develop the situation, and maintain the momentum of the main body. Like the covering force, their support to the advance guard is critical. Their mission in the advance guard is to breach obstacles along the routes where the main body is moving.

Engineers with the flank and rear guards prepare to block enemy AA into the zone. To counter enemy mobility, the engineers quickly emplace obstacles that the maneuver force covers with AT and indirect fires. Engineers must have sufficient quantities of ground-delivered SCATMINEs, cratering munitions, and hasty-bridge demolition materials.

The main body has most of the combat power. It is organized for immediate commitment against major enemy forces or for exploiting disorganized, surprised, or weakened enemy forces. It must not be slowed or deflected before commitment. Engineers in the main body are also well forward. Besides supporting immediate attacks on contact, they reinforce or replace engineers in the security forces and improve on their work.

A result of a MTC is a meeting engagement, during which the unit fixes the enemy in front and attacks from the flank simultaneously. Rapid obstacles provide protection against enemy flank attack. SCATMINEs emplaced directly on the opposing force fix it. These are critical during a meeting engagement to allow friendly forces to retain the initiative. Likewise, the enemy will use rapidly emplaced obstacles to protect their flanks and fix friendly forces. Engineers must prepare to attack through these obstacles to continue the offensive.

ATTACKS

Attacks defeat, destroy, or neutralize the enemy. They are either hasty, deliberate, spoiling, counter, raid, feint, or demonstration.

Hasty

A hasty attack is the most likely result of a meeting engagement. Forces deploy, maneuver rapidly, and attack quickly and violently before the enemy can organize an effective resistance. Units bring combat power to bear rapidly. Responsive combat-engineer support is vital. Quick reconnaissance to locate obstacles, either to bypass or breach in stride, is critical to a hasty attack.

Well-trained engineer units, familiar with supporting-unit operations, contribute to successful hasty attacks. They and the maneuver forces must rehearse breaching operations. Engineer staff planners and commanders should consider the engineer organization for the hasty attack when task-organizing to support a MTC. Success of a hasty attack depends on whether an attacking force can maintain the desired tempo and maneuver within the decision cycle of the enemy.

Deliberate

Units carefully plan deliberate attacks against well-organized defenses that they cannot bypass. Deliberate attacks normally continue deep into enemy-held territory to destroy CPs, capture logistics, prevent the escape of retreating forces, and develop the situation for exploitation. They normally require significant engineer support. As in a hasty attack, the first priority is bypassing obstacles and breaching in stride. However, when the strength of the enemy's defense requires the maneuver unit to conduct a deliberate attack, it normally also must conduct deliberate-breaching operations.

The combined-arms team must dedicate substantial effort to overcome complex obstacle systems and conduct river crossings. Engineers in the deliberate attack are in-depth to support the lead elements, follow-and-support elements, and the reserve.

Deep operations are vital to the success of hasty and deliberate attacks. Using SCATMINEs is one way to attack the enemy's rear area. The engineer is the commander's main advisor on tactically employing SCATMINEs.

Spoiling and Counterattacks, Raids, Feints, and Demonstrations

These types of attacks require obstacle breaching and other mobility tasks. Engineers may do some countermobility tasks in these attacks. The diversionary operations of feints and demonstrations may need engineer units and equipment to complete the deception.

EXPLOITATION AND PURSUIT

Exploitation and pursuit operations begin directly from the attack with minimum regrouping or reconstitution. Engineers plan support for an exploitation and a pursuit before the attack phase to help transition into these operations. Because of the distances, engineers are usually in a command relationship to the exploiting and pursuing forces. Engineer missions are like those for a MTC and an attack. To aid movement, engineers are well forward, since tempo is essential. Their equipment must keep up with the exploiting or pursuing forces.

As exploitations develop, forward engineers hand over missions to follow-on engineers. They assume all engineer tasks behind the attacking force so that forward engineers can accompany and support the exploiting maneuver units.

Armored and mechanized TFs usually conduct an exploitation. Light forces, with engineer support, might assist by seizing critical bridges or destroying key facilities. Success can quickly change an exploitation into a pursuit operation.

Once a pursuit begins, the enemy usually does not have time to employ extensive obstacles. Engineers must expect to meet obstacles that the enemy can employ quickly. Such obstacles could include nuclear or chemical contamination, destroyed bridges, road craters, abatis, and surface-laid mines (manually placed and remotely delivered). Breaching equipment must be well forward to reduce such obstacles.

In an exploitation and a pursuit, LOC are very important. Engineers must open and maintain supply routes, construct and secure support facilities, and mark bypassed or partially cleared obstacles. They move assault and tactical bridging forward to sustain both operations.

TRANSITIONING TO THE DEFENSE

The culminating point in the offense is the time and location that an attacker's combat power no longer exceeds that of the defender. At that point, the attacker either halts to avoid operating at a disadvantage or proceeds, thus becoming weaker than the defender. Ideally, the attacking force does not reach its culminating point before attaining its objective. Engineers must anticipate the culminating point. It is essential that they do not reach their culminating point before the unit they support reaches its. For example, engineers should not expend all of their breaching assets before the force reaches the tactical obstacles in front of the objective.

At the culminating point, the force, or a portion of it, may transition to the defense. The maneuver commander and the engineer must plan for this transition. During the attack, units may reach their culminating points before mission accomplishment. Engineers must prepare to provide the support necessary for the attacking force to maintain its initiative.

When the enemy is the objective, it is unclear where and when the culminating point may occur. In this case, planning for the transition to the defense will be less detailed. When changing from the offense to the defense, engineer-effort priorities shift from mobility to survivability and countermobility. Success depends on the ability of the force to make this shift rapidly. The initial task organization for the offense must consider this transition.

Offensive objectives are those that focus on the enemy and on the terrain. When the commander has a terrain objective, he must control key terrain in his zone. He will either seize or secure the objective. In either case, a portion of the force will transition to the defense. If the commander plans to secure the objective, he needs engineer support to prevent the enemy from regaining control of the terrain. The OPLAN will include a detailed plan for the transition. The engineers will be ready to develop fighting positions to protect the force. They will emplace obstacles to fix counterattacking forces in EAs.

The engineer force may reorganize on the objective. For example, an engineer company will shift internal resources among the platoons after the objective is secured. Engineer assets may be redistributed to support new missions. Once the maneuver force halts, engineers begin defensive preparations. They quickly move their digging equipment forward to assist. The defense requires extensive engineer Class IV and V materials that must be ready to move forward in the logistics system.

Engineers in the offense must prepare to transition to the defense, particularly if the attack is unsuccessful. This requires planning to ensure that Class IV and V materials are readily available. Once in the defense, engineer planners also must plan for resuming in the offense.

CHAPTER 9

Defense

OPERATIONS IN DEPTH

The goal of a defensive operation is to defeat the enemy's attack and transition to the offense. To reach this goal, engineers provide synchronized engineer efforts to deep, close, and rear operations.

The engineer effort in support of deep operations includes analyzing terrain and identifying probable enemy AAs. It also includes planning and executing situational obstacles to disrupt enemy forces. These forces may include committed, reserve, or follow-on enemy units.

During close operations, engineers shape EAs by integrating the effects of direct and indirect fires and tactical obstacles. Engineers plan, coordinate, and synchronize survivability operations to support protecting friendly forces. Finally, they allocate mobility assets to the counterattack force.

Engineers ensure the survivability of C2 and CSS assets by constructing protective positions and providing assistance in constructing protective obstacles. They strengthen base-cluster defenses with obstacles. Engineers also maintain MSRs and facilities.

PERSPECTIVE:

When Germany launched its offensive from the Eifel region against the First United States Army lines in the Ardennes section of Belgium and Luxemburg, it marked the beginning of the Battle of the Bulge. It also set the stage for the development of the largest continuous minefield ever laid on any American division front. The 1st Engineer Combat Battalion planned and installed this extensive 12-mile minefield of 31,480 antitank mines, 127 antipersonnel mines, and 38 trip flares in two weeks, beginning on 20 December. The minefield aided the 1st Infantry Division in firmly repelling three of Von Rundstedt's best divisions, thereby preventing a successful breakthrough in the Monschau shoulder.

ENGINEER FOCUS IN THE DEFENSE

Five engineer functions provide the maneuver commander combat multipliers that significantly increase his combat effectiveness. Understanding the fundamentals of the engineer functions is imperative to successful integration into the maneuver unit's plans.

MOBILITY

Engineers focus on maintaining the force's freedom of maneuver. Counterattack routes are left clear of obstacles or have prepared breaches through friendly obstacles. Engineers construct combat roads and trails for counterattacks and lateral movement between fighting positions. During the fight, engineers rapidly reduce obstacles created by enemy fires, sabotage, or SCATMINEs to maintain friendly freedom of maneuver. Engineers conduct breaching and assault-bridging operations to the reserves or counterattack force.

COUNTERMOBILITY

Engineers integrate tactical-obstacle development to attack the enemy and complement the friendly scheme of maneuver. Tactical obstacles directly attack the enemy's ability to move, mass, and reinforce. Engineers ensure obstacle integration through the proper exercise of obstacle C2, focusing on obstacle-emplacement authority and obstacle control. Engineers facilitate granting obstacle-emplacement authority and obstacle control by developing specific obstacle-control measures. The specific control measures used vary with the echelon of obstacle planning. Finally, engineers ensure that obstacles are reported and that information is disseminated. FM 90-7 is the primary reference for countermobility planning.

Obstacle-Emplacement Authority

Obstacle-emplacement authority is the authority that a unit commander has to emplace reinforcing obstacles. In a TO, theater commanders have the authority to emplace obstacles. Usually, they delegate the authority to corps commanders who delegate it to division commanders. Division commanders retain authority unless a higher commander withholds or restricts it.

Obstacle Control

Obstacle control is the control that commanders exercise to ensure that obstacles support current and future operations. Obstacle control ensures that subordinate commanders emplace obstacles to best support the higher commander's scheme of maneuver. Obstacle control also ensures that subordinate commanders do not emplace obstacles that will interfere with future operations.

Obstacle-Control Measures

Obstacle-control measures are specific control measures that simplify granting obstacle-emplacement authority and providing obstacle control. Obstacle-control measures are obstacle zones, belts, groups, and restrictions.

Echelons of Planning

The nature of obstacle integration from theater level to company/team leads to an echelonment of obstacle planning. At each lower level, engineers conduct more detailed planning. At theater level, planning consists of developing obstacle restrictions and granting obstacle-emplacement authority to subordinate elements. At the company/team level, planning consists of the detailed design and siting plans to emplace and integrate the directed obstacles in the TF obstacle groups. The echelonment of obstacle planning requires engineers at each level to provide subordinate units with the right combination of positive control and flexibility. At each level, obstacle planning builds on the obstacle plan from higher echelons. Table 9-1 shows examples of appropriate obstacle planning at each level.

Obstacle Reporting

Obstacle reporting is a maneuver commander's responsibility at every level. Staff engineers assist him with this responsibility. Engineer units also report obstacle status through engineer channels from the emplacing-unit level to the authorizing-command level.

SURVIVABILITY

Survivability operations include all the aspects of protecting personnel, weapons, and supplies. Engineers plan and construct fortifications such as fighting positions for combat vehicles or protective positions for C2 nodes or supplies. Engineers provide equipment and technical assistance to help units construct other fortifications and protective obstacles. Camouflage and deception operations are other key engineer contributions to survivability. Engineers conceal their critical activities and provide equipment and technical assistance to assist in camouflaging key C2 nodes and CSS activities. An observed engineer effort is effective in painting a false picture. Dummy obstacles, phony minefields, and shallow ditches and weapons positions can be used to deceive and aid force survivability.

GENERAL ENGINEERING

Sustaining defensive operations requires extensive engineer support. Corps engineer units, augmented with engineers from the TA, provide most of the general-engineering effort. Critical general-engineering tasks include maintaining and improving LOC, constructing and repairing support facilities, and constructing airfields and aircraft support facilities.

TOPOGRAPHIC ENGINEERING

During the preparation phase, terrain analysts help the commander understand the terrain thoroughly and identify the military advantages and disadvantages. Engineers are the terrain experts. They tie into the IPB in several ways. Specifically, engineers provide information on terrain analysis and overlays with details on cover and concealment, lines of sight, cross-country movement, and LOC capabilities. They also assist in selecting battle positions and EAs and road and bridge classification products.

As the terrain is modified (bridges destroyed, roads built), the terrain team updates its data base and issues new products. Necessary information is reported through engineer channels. Topographic production facilities update maps with current information based on terrain modifications. This is

Obstacle-control measures

Obstacle-Control Measure	Echelon	Specific Obstacle Effect	Size of Enemy Avenue of Approach/Mobility Corridor	
			Armored	Light
Zone	Division Corps	Optional, not normal	Division/ brigade	Brigade/ battalion
Belt	Brigade	Optional, but normal	Brigade/ battalion	Battalion/ company
Group	Corps Division Brigade Task force	Mandatory	Battalion/ company	Company/ platoon
Restrictions	Corps Division Brigade Task force	Not applicable	Not applicable	Not applicable

generally done by overprinting existing maps. Other information, such as logistics data, planned obstacles, or tactical graphics, can also be overprinted directly on maps. Survey teams prepare the battlefield by establishing a dense network of control points to support artillery operations. They also perform airfield navigation surveys in support of Air Force units operating in the battle area.

PLANNING ENGINEER OPERATIONS IN THE DEFENSE

Engineers prepare for defensive operations using the tactical-planning process. Planning considerations specific to the defense include—

- A thorough, in-depth understanding of the commander's intent, which leads to an obstacle system that not only attacks the enemy where desired but also assists counterattacks and facilitates future operations.
- Defensive operations that consume large amounts of material and engineer munitions, which require time and transport to bring forward.
- Identifying critical engineer tasks early. Terrain preparation requires time for completion. Engineers must not remain idle while final planning is in progress.
- Good OPSEC measures and a specific counterreconnaissance plan. Both prevent premature disclosure of the defense and are essential.
- The engineer combat organization that allows rapid transition to the offense. The reserve must always have a designated force of engineers. Obstacles must allow spoiling and counterattacks to succeed.
- Engineer units that are not held in reserve but remain committed and work on the commander's priority tasks.
- Obstacles for forward deployed forces that are planned and prepared for before hostilities play a major role.

MISSION, ENEMY, TERRAIN, TROOPS, AND TIME AVAILABLE

The engineer must consider the factors of METT-T when planning engineer support for defensive operations:

Mission

The specifics of the mission will dictate the requirements for engineer support. A unit conducting an economy-of-force mission may require additional engineer support to allow it to complete its mission. A unit with a requirement to retain terrain will require significant countermobility and survivability support. As a final example, a requirement to conduct, or support, a counterattack will require breaching assets.

Enemy

The engineer is the expert on enemy engineer capabilities and works with the S2 to advise the maneuver commander on templating the likely enemy engineer COA, types and locations of key enemy breaching

equipment, and enemy mobility organizations. The engineer must also contribute to the R&S effort to help develop PIRs.

Terrain

The engineer provides key products to assist the planning process. Examples include mobility-corridor obstacle overlays, road and bridge classification maps, and line-of-sight diagrams for key defensive positions. Using observation and fields of fire, cover and concealment, obstacles, key terrain, and avenues of approach (OCOKA), the engineer must be able to advise the maneuver commander on the advantages and disadvantages of each piece of terrain from the friendly's and enemy's points of view.

Troops

The engineer must have precise accountability of all personnel and equipment available, to include combined, joint, and HNS assets. During initial planning, the engineer must aggressively assist the task organization decision-making process. Unit and equipment assignments are critical to ensure proper command and support relationships throughout the conduct of the defense.

Time Available

After receiving the WO, the engineer must establish a time line. Depending on the amount of time available, he may choose to plan in a deliberate, combat, or quick manner. Planners must include all critical events on this time line, including OPORD issue, rehearsals, and precombat inspections.

TASK ORGANIZATION

The engineer commander and staff need to determine quickly the scheme of engineer operations that best supports the maneuver commander's intent. In anticipation of the defense, efficient use of available time demands establishing and linking up engineer units and equipment with their supported elements early.

The engineer recommends the best command or support relationship to the maneuver commander. Normally, the majority of engineers are placed in DS or GS of the defending forces. This allows efficient allocation of engineer resources and allows engineers to mass on the critical defensive tasks. Frequently, engineer planning HQ will link up with maneuver forces and conduct planning and coordination. Meanwhile the subordinate elements of the HQ are committed to supporting priority efforts elsewhere.

Although engineers are not held in reserve, they must be available to provide support to maneuver reserves or counterattack forces. These engineers will initially support defensive preparations and then support the reserve or counterattack force as a follow-on mission. They will require sufficient time to link up, plan, refit, and rehearse before executing the follow-on mission. Depending on METT-T, this will probably require 12 to 24 hours.

PREPARATION

When preparing for combat in the defense, engineer involvement is proactive at all levels. Immediately after receiving the WO, engineer staffs prepare an estimate and initiate movements and linkups, as necessary. Continual use of WOs keeps subordinates informed and current in the preparation process.

Immediate precombat inspections identify any shortcomings and initiate necessary corrective steps, such as equipment maintenance. CSS planning is just as important and is integrated throughout the orders process. Class IV and V points are planned and established early. The staff also determines the availability and capability of resupply assets.

ENGINEERS IN THE DEFENSE

The mobile defense and the area defense are the characteristic patterns of defensive operations. The defense actually employed usually combines elements of both. For simplicity, they will be discussed separately.

MOBILE DEFENSE

A mobile defense orients on destroying the enemy force by using a combination of fire and maneuver, offense, defense, and delay to defeat the attack. It focuses on destroying the attacker in the depths of the defensive sector through the use of counterattacks. Defenders place minimum forces forward, forming powerful forces with which to strike the enemy at its most vulnerable time and place. The striking force can be from one-half to two-thirds the size of the total force, but it must have greater mobility than the attacker.

Because the defense involves significant battlefield maneuver, engineer forces focus on mobility operations. Engineers positioned with the counterattack force are reinforced with breaching and gap-crossing assets. They are prepared to reduce or cross existing obstacles such as railway embankments or rivers. They coordinate passage through lanes and prepare to breach friendly obstacles. They also prepare to breach enemy obstacles emplaced by air, artillery, or ground means. Engineers construct combat roads and trails to allow friendly forces in defensive positions to reposition from one position to another.

The successful mobile defense depends on the correct integration of maneuver, fire, and obstacles to wrest the initiative from the attacker in the defended area. Tactical obstacles are used to disrupt and delay enemy forces and to assist in the separation of echelons. Engineers also play a major role in establishing the conditions for the counterattack. They construct tactical obstacles to turn the enemy into engagement and objective areas and fixed obstacles to support the enemy's destruction by fires. Obstacle restrictions are common to protect the friendly forces freedom of maneuver. Other obstacle-control measures are smaller and less permissive for the same reason.

Engineers assist in developing survivability positions in depth. Repositioning units will require numerous fighting and protective positions. Because there will rarely be enough engineer assets, and therefore less survivability positions than desired, the most critical positions must be identified and constructed. Protective obstacles will be more important in protecting base clusters against rear threats, as forward units will likely move before the enemy's assault.

A decentralized engineer force distributed among the maneuver elements allows commanders the necessary flexibility. The engineers may have a command relationship with the supported maneuver forces.

AREA DEFENSE

Commanders conduct an area defense to deny the enemy access to designated terrain or facilities for a specified time. They retain terrain by drawing the enemy into an interlocked series of positions from which fire can destroy it. The bulk of the defenders fight forward in well-prepared defensive positions, with only small mobile reserves. The reserve in an area defense will be up to one-third of the entire force.

Preparing for an area defense is key, and the engineer effort is extensive. Retaining centralized control over engineer units and their resources is the most efficient method to prepare the area defense. Therefore, engineers generally are employed under their own commanders in a support relationship to maneuver forces. Once the battle is joined, a minimal number of engineers remain with the committed forces in a command relationship to allow rapid repair of obstacles and fighting positions and to provide support for local counterattacks. The bulk of the engineers withdraw to work on subsequent defenses in depth.

Tactical obstacles are used to force the enemy into EAs. Other tactical obstacles not only fix the enemy in the EA but also block his further advance. Additionally, obstacles are used to block the enemy from using AAs that will allow him to avoid the main defense. Disrupting obstacles are used just forward of EAs to fragment the enemy force and allow the defender to deal with only a small portion of the enemy at a time. The obstacle-control measures are used as permissive as possible to ensure that the subordinate commanders have the freedom to integrate extensive obstacles with their fire and maneuver.

Fighting and protective positions are more deliberate, and supplementary and alternate positions are more prevalent, in a mobile defense. Dismounted infantry will construct fighting positions able to withstand artillery attacks. Protective obstacles will be dense and interlocked around, and within, battle positions to help defeat the enemy's final assaults. Because defending forces will likely occupy their positions for longer periods of time, camouflage becomes increasing important.

On occasion, maneuver commanders may direct constructing a strongpoint to deny key terrain to the enemy and force its movement in a different direction. Constructing a strongpoint requires considerable time and engineer support. Generally it takes an engineer unit of the same size as the defending unit, working for one day, to create a strongpoint.

TRANSITION TO THE OFFENSE

Gaining the initiative and employing offensive operations are vital to victory. Opportunities are actively sought throughout the defense to transition to the offense. Employing obstacles in zones and belts, consistent with the commander's intent, permits free maneuver and allows offensive operations to occur rapidly. Engineers are task-organized throughout the maneuver organization to assist rapid deployment from defensive positions and through battlefield clutter when the enemy attack has reached the culminating point. Engineers at all levels plan for the transition to the offense as the sequel to a successful defense. They ensure that the engineer structure is designed to provide the necessary movement.

CHAPTER 10

Retrograde

ENGINEER FOCUS IN RETROGRADE OPERATIONS

A retrograde operation is a maneuver in the rear or away from the enemy. It is part of a larger maneuver scheme to regain the initiative and defeat the enemy. Its purpose is to improve the current situation or prevent a worse situation from occurring. Its objectives are to gain time, preserve forces, avoid combat under undesirable conditions, or maneuver the enemy into an unfavorable position. Retrograde operations may facilitate repositioning forces, thereby, shortening LOC, or permitting unit withdrawals for employment elsewhere.

MOBILITY

Forces conducting retrograde operations must be at least as tactically mobile as the enemy. Requirements for combat trails are similar to those necessary for the defense. The enemy attempts to isolate units and disrupt the retrograde operations using aircraft, artillery, and airborne/airmobile forces. They will emplace mines, destroy bridges, and otherwise restrict maneuver at choke points and river-crossing areas. Breaching operations will clear lanes through obstacles to prevent force isolation and encirclement.

In retrograde river crossings, forces cross on existing permanent bridges, when available. Engineers prepare the bridges as reserve demolition targets. To ensure bridge destruction, responsible commanders provide multiple demolition systems, positive C2, and adequate demolition guards. When the potential tactical advantage to the enemy is great, engineers destroy major bridges in advance. Final retrograde operations then will take place over tactical-bridging equipment, and the last forces will swim or ford.

Mobility support is also important in the rear area for the retrograde to succeed. It is essential that support units move to the rear, well ahead of the combat elements conducting retrograde operations. Logistics units contain large numbers of slow-moving wheeled vehicles that can rapidly clog routes. Engineers must react instantly to repair damage and physically remove destroyed vehicles from roadways. Commanders position engineer units along major routes, with concentrations near likely choke points. Engineers conduct limited road maintenance that will allow forces to pass. Engineers anticipate interdiction obstacles and react to reduce them immediately.

COUNTERMOBILITY

Units should use obstacles to attack the enemy's ability to conduct exploitation and pursuit operations. The principles of obstacle employment in retrograde operations are essentially the same as for other operations. Units employ obstacles and minefields in depth and along the primary AAs. Threat doctrine emphasizes pursuit along parallel routes. Engineers must emplace flank obstacles to protect against envelopment. SCATMINEs delivered by ground or air are best. Division engineers fight their way back with the maneuver forces. They emplace protective obstacles to allow maneuver units to break contact and protect against flank attacks. They also prepare tactical obstacles during retrograde operations. Obstacle emplacement usually extends over a much greater area, in width and depth, than in a defense.

Obstacles supporting retrograde operations slow or break up the enemy's advance. They turn the enemy into EAs and fix the enemy under AT fires. In both cases, units do not execute critical obstacles along passage routes until most of the friendly forces have withdrawn. These key obstacles are reserve obstacles; controlling their execution is critical. As in the defense, planners use maneuver-control measures (zones, belts, groups) to ensure that obstacles support the commander's intent for friendly maneuver and synchronization.

SURVIVABILITY

Forces conducting retrograde operations require protective positions for tactical vehicles. To schedule effort properly, engineers must know the routes used during retrograde operations and the planned sequence of events. Commanders enhance force survivability by being able to retain flexibility. Aggressive mobility operations and using obstacles and fires to attack an enemy pursuit provide that flexibility.

GENERAL ENGINEERING

General engineering in support of retrograde operations is essentially the same as in defensive operations. Support elements displace early to make room for units that will conduct retrograde operations. They must have facilities to move in to clear routes and continue uninterrupted support. Corps and theater engineer forces are responsible for the necessary construction.

TOPOGRAPHIC SUPPORT

Topographic support to retrograde operations is similar to that in the defense. Engineers, as terrain analysts, identify the best routes that combine good-movement characteristics with maximum cover and concealment. They also identify potential retrograde positions. Terrain teams continue to gather terrain information and update their data bases to provide for future operations in the area. Production teams provide special overlays and overprints showing routes and traffic-control measures to assist synchronizing the operation.

PLANNING ENGINEER OPERATIONS FOR RETROGRADE

The tactical planning process outlines how engineers plan. Specific retrograde considerations include—

- A high degree of centralized control, even though execution is decentralized. There are more reserve obstacles to ensure successful maneuver of units that conduct retrograde operations.
- Units conducting retrograde operations that must retain a mobility advantage over the attacker.
- Obstacle emplacement that usually extends over greater depth than for the defense and must be planned far ahead of operations.
- Deception, which is a vital component of all plans.

MISSION, ENEMY, TERRAIN, TROOPS, AND TIME AVAILABLE

Engineers preparing to support retrograde operations consider the METT-T factors when estimating the situation:

Mission

Engineers must understand the maneuver commander's mission, intent, and end state and be able to prioritize support for retrograde operations in terms of M/CM/S.

Enemy

Just as the maneuver commander must consider the strength, location, tactics, mobility, and capabilities of the enemy on retrograde plans, engineers must understand the enemy engineer's organization and capabilities. Engineers focus on the enemy engineer's breaching assets and interdiction capabilities needed to support enemy maneuver for the duration of the mission and follow-on missions.

Terrain

The engineer conducts an EBA. During this assessment, he conducts an OCOKA analysis, based on terrain and weather characteristics and how it can support retrograde operations. The engineer advises a unit on its positions, routes, lanes, and trails, making maximum use of terrain to support the maneuver. He must consider terrain and weather effects on the enemy and on the commander's intent.

Troops

The engineer troops available to support retrograde operations is a critical consideration for maneuver and engineer commanders. The more intricate the maneuver plan is in terms of number and length of routes, lanes, trails, and survivability positions, the more engineer troops the operation requires. The maneuver commander may have to consider using his own assets to execute the retrograde successfully.

Time Available

Time to plan, prepare, and execute retrograde operations is a critical consideration for the engineer. Engineers must prioritize the engineer effort to meet the maneuver commander's intent. Available engineer assets (soldiers and equipment) are integral in determining time available.

TASK ORGANIZATION

The engineer develops a task organization for retrograde operations the same way as for other types of operations. Determining a task organization begins in the EBA phase of the engineer-estimate process. During mission analysis, the engineer determines available assets and examines the total force structure of the combined-arms team. During the scheme of engineer operations development, he identifies the engineer missions and allocates forces that support the retrograde operation.

PERSPECTIVE:

In June, massive North Korean forces invaded South Korea. By July, the North Koreans were forcing Republic of Korea (ROK) and American units to the southern tip of South Korea. The 3d Engineer Battalion, 24th Infantry Division arrived in country during the first week of July. Within days, Company B, supporting the 12st Regimental Combat Team [RCT], prepared bridges for demolition, constructed roadblocks, and blew craters in roads. Company D, supporting the 34th RCT took on similar tasks. Working night and day, often under mortar, artillery, small-arms fire, the engineers laid antipersonnel minefields and placed numerous demolitions. Teams were posted to prevent premature blowing of bridges and craters. At one point, Company B had to replace a railroad bridge destroyed by North Korean aircraft. The tracks were repaired in 5 hours, and trains resumed their movement along the line. In a 17-day period, the 3d Engineers made 14 reconnaissances, maintained 1 airstrip and completed another, repaired 25 roads, built 1 bridge, destroyed 56 highway and 11 railroad bridges, blew 19 road craters, laid 1 antitank and 1 antipersonnel minefield, and blew 6 tunnels. In the coming weeks, the battalion would be deployed as infantry, spending 17 days in the line or in active reserve. In the period from July 23 to August 25, the battalion blew 24 road craters; destroyed 1 railroad and 12 highway bridges; installed 4 antipersonnel and 3 antitank minefields; constructed 5 airstrips, 3 fords, and 3 bridges; and repaired 68 miles of road.

Delays

Engineers can expect to play a major role in the maneuver commander's overall plan for a delay. Units conduct delays when their strength is insufficient to attack or defend or when they want to maneuver the enemy into an area for a subsequent counterattack. Delays—

- Gain time for units to reestablish the defense.
- Cover a defending or withdrawing force.
- Protect a friendly unit's flank.
- Participate in an economy-of-force effort.
- Slow or break up the enemy's momentum or do not allow it to begin. The commander's intent must specify the duration of the delay, the terrain requirements, and what operations to expect. Engineers plan the assets needed to support the delay. They also consider the enemy situation. The

enemy's capabilities have a direct impact on planning and task-organizing for the delay. Engineers should examine the enemy's vulnerabilities, strengths, and likely COAs when developing their support plan.

Terrain determines the commander's options for designing delays. For example, open and unobstructed terrain makes a delay more difficult because of the major engineer effort required. Rugged, swampy, and wooded terrain help a delay by slowing down the enemy and reducing the amount of engineer effort required. Obstacles should complement terrain.

During the delay, engineers' efforts center on countermobility; however, they also improve the delaying force's mobility and survivability. As units move to their subsequent battle positions, obstacles close routes to the advancing enemy. Units report these obstacles to the higher HQ so the commander knows whether the enemy is able to exploit an open mobility corridor into the next defensive line. Friendly units must quickly pass through obstacles to reach subsequent battle positions. Engineers can expect breaching and other mobility missions to keep withdrawal and supply routes unobstructed. Mobility improvement will continue to the battle positions, in depth.

Delaying commanders attempt to avoid decisive combat because of their forces' size. They must frequently pass units through each other forward, rearward, or laterally to keep them fresh, throw the enemy off balance, and preserve the forces' integrity. As a rule, the delaying force needs to be at least as mobile as the enemy's. This means that engineers must be able to construct significant obstacles and battle positions, in depth. This can require a significant engineer effort to ensure that mobility lanes exist between battle positions.

The maneuver unit maintains flexibility through in-stride breaching and river-crossing operations. A delaying unit may be required to conduct hasty river-crossing operations. The commander and engineer should anticipate the need for breaching equipment and have it available, when necessary. Flexible planning allows the units conducting a river crossing to adapt quickly to changes during execution. Some important features of a flexible plan include¯

- Multiple approach routes from battle positions to crossing sites.
- Lateral routes between crossing sites.
- Alternate crossing sites if threat actions close primary sites.
- Crossing equipment held in reserve to replace losses or open alternate sites.
- Preplanned EAs to block enemy advances. A delay is most effective when the deception confuses the enemy as to the true intentions of the delaying force. Obstacles must not reveal friendly positions or plans. Concealed, dummy, and expedient obstacles help in deception operations. Deception, therefore, can be considered a force multiplier.

Commanders must use available time effectively so subordinates have enough time to plan and prepare their operations. They must remember that the longer the force delays, the more engineers will need support to sustain the operation.

Withdrawal

Units conduct withdrawals to extract forces from combat, adjust defensive positions, or relocate. Friendly forces voluntarily disengage from the enemy and move rearward. The enemy usually does not pressure

withdrawing units. Also, other friendly units do not normally assist in withdrawals. Engineers may emplace obstacles to prevent or slow direct enemy pressure. If the enemy tries to impede the movement of withdrawing forces, engineers must be prepared to reduce obstacles and repair routes. Breaching and river-crossing operations may also be necessary to prevent force isolation and encirclement.

Deception operations are important when protecting friendly forces, and engineers assist in the deception. False defensive positions deceive the enemy about the true location of friendly forces. METT-T determines the method or materials used for deception operations. Since engineer activity is a scarce resource, it is very effective in portraying a false picture. Dummy obstacles, simulated minefields, shallow ditches, and weapons positions can deceive the enemy and aid force survivability. Deception measures also degrade enemy C2 by creating confusion.

If a unit has difficulty breaking with the enemy in a withdrawal, it can request help from a higher level. The assisted withdrawal will be a rearward passage of lines. Engineers from both units coordinate during the planning and execution of the passage. They exchange information on obstacles and routes in the sector. The assisting unit provides mobility support along cleared routes and corridors in its sector for the passing unit.

Engineers must complete clearing operations before the passage begins. The assisting unit also closes the lanes once passage is complete. The passing unit must plan and organize for in-stride breaching and, if necessary, river-crossing operations before initiating the passage of lines. This should ensure responsive mobility operations if the enemy blocks routes during the passage. An unassisted withdrawal occurs when the withdrawing unit is not under enemy pressure. Engineers perform similar missions as an assisted withdrawal except they only use internal assets.

Retirement

A retirement is units not in contact with the enemy moving to the rear area. Engineers plan a retirement as they would a withdrawal. The commander must have the assets available for possible breaching and river-crossing operations. Speed is important; therefore, engineers should focus on mobility for the retiring unit and expect operations such as route clearance and route repair. They can also expect countermobility and survivability missions in support of the rear guard force.

Transition in Retrograde Operations

Detailed planning and execution are key to a successful transition. Planning can be deliberate, which could happen before a maneuver starts. Planning can be rapid, which would occur at the same time as an operation.

Transition to the Offense

Gaining the initiative and employing offensive operations are vital to success. Situations could arise during retrograde operations that could allow a transition to the offense. Obstacle zones and belts allow free maneuver and offensive transitions to occur rapidly. Since the priority of engineer support and task organization during retrograde operations is essentially the same as in the offense, the transition should be smooth. The engineer commander must ensure that the engineer structure provides the necessary physical agility for the maneuver commander.

Transition to the Defense

The maneuver commander and the engineer must plan for transition to the defense. The OPLAN will include a detailed plan for the transition. Engineers must be ready to develop fighting positions to protect the force and emplace obstacles to fix the attacking forces' areas and deny them the ability to quickly overrun positions. Since it is unclear where and when that may occur, planning for the transition to the defense will be less detailed. When changing from retrograde to defense, priority of engineer support shifts from mobility to survivability and countermobility.

Success depends on the force's ability to make this shift rapidly. The initial task organization for the retrograde should not change significantly. The engineer commander must provide additional support for survivability and countermobility when preparing and while transitioning to the defense. Engineers with the maneuver force immediately begin defensive preparations, supported by follow-on engineers. Engineer digging equipment is brought forward quickly to assist. The defense requires extensive engineer Class IV and V materials, which must be ready to move forward in the logistics system. The defense also must retain the flexibility to resume retrograde operations for the offense, if necessary.

DENIAL OPERATIONS

Denial operations have always been a part of war and, on occasion, have attained significant importance. Today, we conduct combat operations according to the laws of war. We take all reasonable precautions to avoid incidental injury to civilians and minimize unnecessary damage to their objects. The laws of war require that denial operations, particularly against civilian facilities and resources, be carefully considered and that execution authority be maintained at the highest levels.

Destroying or removing objects that have a tactical or strategic use (denial targets) could reduce the enemy's benefit from capturing an area. Engineers play a major role in executing denial operations because of their heavy equipment and demolition capabilities. Even though engineers execute certain denial measures, they must not be confused with obstacles. Obstacles are employed to attack the enemy's mobility. A denial target may be an obstacle and can be included in an obstacle plan, but its primary purpose is to deny an immediate benefit to the enemy.

TARGET SELECTION

An effective denial operation focuses on objects with high military value. Whenever possible, they are selected to aggravate enemy weaknesses and limitations. Commanders should ensure that denial targets—

- Disrupt the enemy's logistics-support capabilities.
- Prevent the use of local materials, supplies, and equipment to reinforce offensive capabilities.
- Require the enemy to divert significant engineer effort for repair.
- Restrict mobility. Denial targets should accomplish at least one of these criteria, in a substantial manner, with the least possible amount of damage to civil property.

LIMITATIONS

Denial operations are somewhat restrictive. Only those civilian targets with a clearly identified military value can be destroyed or removed. Looting or excessive destruction is prohibited. Policy states that objects such as churches, medical supplies, and hospitals are protected against destruction unless the enemy uses them for military purposes.

PLANNING

Detailed planning must occur at all levels to implement established denial policy. Coordination between the theater command and the HN governments is important in the policy development process. Operations plans and orders assign denial targets and mission responsibilities at corps and subordinate levels based on this policy. Each corps and division then prepares formal denial plans.

Military supplies and equipment are evacuated when possible. If they cannot be evacuated, they are destroyed so the enemy cannot use them. All available means of transportation, to include civilian vehicles, must be used to save as many supplies and as much equipment as possible. Coordination is essential to ensure that denial operations do not isolate or remove vital support from friendly elements.

PERSPECTIVE:

As Union forces advanced near Yorktown in 1862, the Confederate rear guard set out to delay the Union movement. One commander, BG Gabriel Rains, planted a number of artillery shells in the road with contact fuzes or trip wires. This became the first documented use of contact mines in American history. The tactic worked as Union cavalry became increasingly hesitant to move along the various roads due to the potential of death from the "subterra shells." Subsequently, similar mines were used to supplement coastal fortifications, defend Richmond, and delay Sherman's march to the sea in 1864.

CHAPTER 11

Logistics

FORCE SUSTAINMENT

Logistics is the science of planning and executing the movement and maintenance of forces. A force-projection Army depends on the right logistics decisions before the onset of operations. There is normally little time for last-minute logistics fixes when the decision to employ forces is made.

Engineer-force sustainment is critical to maintaining and multiplying combat power. Logistics operations must accurately anticipate engineer CSS needs. Many engineer needs are unique, one-of-a-kind requirements that demand the logistician to improvise and the logistics system, often times, to become strained. Special engineer equipment is of low density, requiring intensive management to ensure that it is available for mission use. Engineer-mission materials are normally bulky, heavy, and hard to transport. They must be requisitioned, transported, stockpiled, and issued in a streamlined manner. Engineers play a key role in supporting theater logistics operations by constructing and upgrading logistics bases, troop bed-down facilities, airfields, ports, and MSRs. This chapter focuses on sustaining engineer units and engineer support to logistics operations. For more information in this area, see FMs 100-7, 100-10, and 100-16.

THE UNDERPINNINGS OF LOGISTICS

The objective of logistics is to ensure that operations succeed and facilitate the commander's ability to generate and mass combat power at the decisive time and place. Logistics is a major BOS at each level of military operations. Strategic logistics supports wars, campaigns, and major operations. Operational-logistics support encompasses those activities required to sustain campaigns and major operations and to enable success at the tactical level of operations. Engineers closely support operational-logistics operations in areas such as—

- Constructing bed-down facilities for force reception, onward movement, and sustainment.
- Opening ports and airfields to develop theater infrastructures.
- Assisting in distributing and managing materiel, movements, personnel, and health services by constructing MSRs and other logistics-support facilities. Tactical logistics encompasses all the CSS and engineer activities required to sustain the tactical commander's ability to fight battles and

engagements. Successful tactical logistics provides the right support at the right time and place to units. Engineers receive tactical logistics support from CSS agencies located at the maneuver brigade through the TAACOM level in the areas of manning, arming, fueling, fixing, moving and sustaining. Engineers support tactical logistics operations in areas such as—

- Constructing forward-area rearm/refuel points (FARPs).
- Digging in ammunition supply points (ASPs) and corps logistics C2 nodes.
- Erecting fixed bridging along forward supply routes. Regardless of the level of military operation, the engineer CSS structure and resource requirements depend on the METT-T. The engineer logistics-support structure fully supports the commander's intent and is integrated into the commander's concept of operation. Trade-offs between combat- and construction-engineering capabilities directly affect this CSS capability.

LOGISTICS CHARACTERISTICS

Successful logistics support is balanced between being effective and efficient. Logistics operations are characterized by being able to anticipate requirements, integrate joint and multinational CSS, improvise solutions, and be responsive and continuous. These characteristics facilitate effective, efficient CSS and enable operational success. They apply in both war and contingency operations. These imperatives act as a guide for planners and operators to synchronize logistics on the battlefield. The engineer unit commander and his staff understand and use these while planning engineer operations. The following paragraphs describe these characteristics along with the engineer considerations for each:

ANTICIPATION

The planner who anticipates is proactive, not reactive, before, during, and after operations. The ability of the force to seize and maintain the initiative, synchronize activities along the entire depth of the battlefield, and exploit success depends on the commanders', logisticians', and engineers' abilities to anticipate requirements.

Engineers consider joint, multinational, contract civilian, and interagency assets when planning support for engineer operations. They—

- Use all available resources to the fullest, especially HN assets.
- Prioritize critical engineer activities based on the concept of operations.
- Anticipate engineer requirements based on experience and historical knowledge.
- Concentrate first on critical mission stoppers and then move to the next item.
- Participate in and evaluate the engineer significance of each phase of the operation during the entire command estimate process, to include mission analysis and COA development, analysis and war gaming, recommendation, and execution.

Predeployment and Deployment Phases

As soon as the commander begins operational planning and development of COAs, the engineer planners should assess the potential support infrastructure and develop a civil-engineering support plan. The engineer should then apprise the logistics and operations planners of the capabilities of infrastructures

and options for engineer support. Since all military operations depend on a robust theater infrastructure system, base development should be placed high on the force-projection theater commander's priority list. A foreign country's infrastructure cannot be developed overnight to support force-projection operations. Normally the country's infrastructure is built only to sustain indigenous population and industry, with minimal additional capacity being available to support US and coalition forces.

The theater needs to have the capacity to flow large numbers of units through its air and seaports. The theater also needs facilities to manage such functions as C2, storing and transferring ammunition, maintaining equipment, storing and moving bulk petroleum, generating and distributing power, and staging and billeting rear-area troops, which are necessary for a synchronized flow of support to occur.

Moving follow-on forces and supplies is critical to success. Engineer planners work closely with the logistics staff to develop a suitable transportation infrastructure (roads, bridges, and airfields). Anticipating engineer requirements is crucial to ensure that adequate time is available to complete a robust infrastructure. Much of this work can be done by HN or civilian contractor personnel. These facilities can also be improved with the foresight of using engineer assets before the operation and during contingency operations.

Base development does not end once the operation begins. Base-development needs will increase depending on the size of the force involved in the operation. Each time the force expands or contracts, planners review facilities and LOC requirements to ensure that they are adequate to accomplish the mission.

Entry and Operations Phases

The nature of engineer entry and operations phases places an extraordinary burden on the logistics structure. Rates of fuel consumption, repair parts, construction and obstacle materials, mines, and explosives dictate the commitment of a large amount of maintenance and transportation assets in support of engineers. Engineer operations, by their nature, are dangerous. Engineer planners, therefore, anticipate and provide for replacing engineer losses.

War Termination, Postconflict Operations, and Redeployment Phases

After completing operations, engineers may be asked to restore the area and construct redeployment facilities. This phase of force-projection operations is critical to ensuring victory. Depending on the political and social factors of an operation, devastation may require our forces to do some restoration. This will require attention to detail in logistics anticipation planning and, most likely, in rotating follow-on engineer units working in concert with HN and civilian construction contractors.

INTEGRATION

Operational and tactical plans integrate all logistics support so that it creates a synergism with the concept of operation. Engineer planners participate in and evaluate the logistics significance of each phase of the operation during the entire command estimate process. They create a clear and concise concept of support that integrates the commander's intent and concept of operation. This includes analyzing the mission; developing, analyzing, war gaming, and recommending a COA; and executing the plan.

Engineers will most likely support joint and multinational operations. The theater commander integrates operations in his area of responsibility, which often includes engineers from other services or countries and possibly civilian-engineering contractors.

RESPONSIVENESS

Versatile CSS systems—

- Enhance the engineer unit's responsiveness.
- Adapt engineer change requirements without interrupting the flow of support. In this respect, responsiveness is closely tied with improvisation. Theater logistics planners structure the logistics force to be versatile enough to compliment engineer plans and operations yet be robust enough to ensure that engineer services are not interrupted. The structure is responsive enough to allow the engineer commander to seize and maintain the initiative.

  Engineers plan to meet the changing requirements of the operation on short notice. The engineer sustainment system should be versatile enough to keep pace with rapid-decision cycles and mission execution and also react rapidly to crises or opportunities. Engineer planners are sensitive to engineer task-organization changes. Engineer units can normally respond to a change in task organization much quicker than theater CSS packages can. Because of this, contingency engineer sustainment plans are normally developed.

CONTINUITY

The engineer commander needs continuous logistics capability to gain and maintain the initiative. Pauses for rebuilding power impede momentum and rob the command of the initiative. Engineer planners synchronize all CSS assets to ensure that the support operation is transparent to the engineer commander. Continuity of operations is critical to success.

Engineers are either committed to the current operation or preparing for the next one. The tempo of the battlefield requires a constant vigilance by the logistician and engineer commander to ensure a constant flow of support. Supplies are pushed (unit distribution method) forward whenever logistically feasible. This is especially crucial to engineer units because they do not usually have lulls in their operations that would allow them to use the supply-point method of supply.

IMPROVISATION

Extraordinary methods may be necessary to ensure success on the battlefield. Logistics planners attempt to push support to engineer units forward to ensure smooth combat operations. Sometimes this is not feasible or supportable. In such cases, engineers improvise by making, inventing, devising, or fabricating what is needed out of what is on hand. Two such examples are—

- Creating a demolition cratering charge using common fertilizer and diesel fuel.
- Using diesel fuel as a substitute for unavailable dust palliatives, as during Operation Desert Storm. Specific damage assessment-and-repair procedures have been developed based on the need to improvise during the operation. Improvisation is not a substitute for good planning; requirements must be anticipated. Improvisation can be a great strength; engineer personnel must recognize it as

an advantage in meeting emergencies.

ENGINEER LOGISTICS PLANNING CONSIDERATIONS

Planning for engineer logistics support involves several critical decisions of interfacing combat, CS, and CSS in the theater. A theater engineer-support concept is developed that complements operations and enhances the ability of units to accomplish their missions. The concept includes support to engineers along with how they support the theater logistics system. Several engineer and logistics planning considerations are critical to this concept development.

ENGINEER PREPARATION OF THE THEATER

Engineer preparation of the theater is those actions taken before a crisis that enhance future logistics support during future force-projection operations. Engineers can—

- Assist in this process by identifying and preparing bases of operation and forward logistics bases.
- Select and improve LOC.
- Identify theater construction equipment and materials.
- Improve the infrastructure of the theater through various operations, such as nation assistance and disaster-relief activities.

LOGISTICS FORCE COMPOSITION

Deployment speed and the expected threat level will dictate how the logistics force is structured in theater to support engineers. The majority of initial logistics forces in an objective area may be the active component working with joint, HN, and coalition logistics-support agencies, especially in the early stages of force-projection operations. As the operation becomes longer, reserve-component logistics forces will be phased in.

Government civilians and contractors can provide many specialized logistics functions for engineers, possibly requiring their integration into operations and requiring detailed advanced planning. Some engineer construction units, such as combat heavy engineer battalions and port-construction companies, may be task-organized and phased into the theater as logistics forces deploy and arrive.

ENGINEER LOGISTICS PRIORITIES

Limited resources will always be a planning consideration for the theater commander when establishing priorities for engineer units. Establishing logistics priorities considers a variety of factors such as the—

- Commander's intent.
- Commander's concept of the operation.
- HN assets.
- Joint-service capabilities.

- Multinational capabilities.
- Civilian-contracting capabilities.
- Systems interoperability.
- Availability of sea- and airlift into the theater.
- Suitability of air, ground, and sea LOC. Logistics priorities can shift between engineer units or be focused on a particular area. Shifting priorities between engineer units or work areas requires the logistics planner to scrutinize and coordinate closely to ensure that there are no lapses in support. Shifting priorities from one location to another is an extremely complicated process with the high potential for failure. Some examples of potential reasons for shifting priorities are—
- Reconstituting the engineer force.
- Exploiting weaknesses.
- Preparing for future operations.
- Continuing with the success of a current operation. Engineers may receive a priority for certain CSS, such as Class IV construction materials or Class V mines and demolitions. A priority for engineer bridge companies may be to support logistics line-haul operations after downloading bridges. Priorities for engineer work may be to construct logistics bases and MSRs.

JOINT LOGISTICS SUPPORT FOR ENGINEERS

The nature of joint logistics support for engineers at the strategic level ensures its integration with national systems. Integrating joint logistics at the operational level requires detailed planning and synchronization between all service engineer organizations. The logistics force structure for a joint operation usually requires multiple task-organization changes as the theater matures.

The CINC or JTF staff will ensure that logistics for engineers are integrated by delegating responsibility for various supply classes. For example, the Air Force may be responsible for all aviation fuel and Class XIII (medical) supplies and the Army for Class I (food and water) and Class III (bulk and diesel) supplies, while each service would handle its own Class V (ammunition) supplies. Army engineers could receive Class IV materials from joint-service supply points, such as the ones the NCBs established.

MULTINATIONAL LOGISTICS SUPPORT FOR ENGINEERS

Logistics support for engineers in a multinational operation is much the same as in a joint environment, but much more complicated. Logistics support is normally a national responsibility, but arrangements may be made for US logistics agencies to supply coalition engineer partners with such things as—

- Food and water.
- Some ammunition.
- POL.
- Medical supplies.
- Construction and obstacle materials.
- Mines.
- Some vehicles and maps. Although some logistics functions may be suitable for national

operations, many are not. Movement control; operation and use of ports, airfields, or LOC; and logistics communication systems are examples of supply functions better suited for multinational OPCON. Weapons, engineer equipment, and C2 systems compatibility is the largest obstacle to overcome in synchronizing logistics in a multinational operation. How to integrate and synchronize multinational assets depends on many factors. Technological capabilities, tactical training, national economic well-being, HN contracting capability, political issues, or even cultural differences are all considerations in determining an appropriate logistics system to support engineers.

If members of an alliance use similar engineer equipment or systems, plans should include consolidating maintenance, resupply, and other support operations. Although many of our possible coalition partners have bought like engineer equipment systems, such as the bulldozer or grader, none of their systems are completely compatible with ours. Incompatibility with coalition communication systems can be an even larger problem for synchronizing adequate multinational logistics support. LOs are essential to ensure successful multinational logistics operations to support engineers.

HN SUPPORT FOR ENGINEERS

Using HN assets allows greater flexibility to assign US logistics units other missions that are more critical to success on the battlefield. It also reduces the initial requirements for strategic sea- and airlift, which allows critical transportation assets to be dedicated to deploying more required forces. However, HNS should not be relied on for a sole source of logistics support to engineers.

Preestablished HNS agreements, such as status of forces agreements (SOFAs), can significantly improve logistics-support systems to engineers. These agreements must be made before hostilities break out and cannot be relied on for critical engineer requirements. Regardless of the presence of a preestablished agreement, the theater commander must ensure that the force has contracting capability deployed early enough to acquire the necessary HN assets. Some of the typical logistics support that HN assets can provide to engineers are–

- Government agency support. The HN may operate systems such as utilities and telephone networks in support of engineers. It can also provide police, fire, and local security forces in support of engineer operations.
- Contractor support. HN, third-country nationals, or US contractors can provide engineers supplies and services such as labor and construction. LOGCAP contracts can also provide these services.
- HN civilians or third-country nationals. These civilians can perform a wide array of services for the commander. Some of the civilian engineer skills that may be required include linguists, laborers, stevedores, truck drivers, rail operators, utility specialists, and technicians.
- HN engineer units. HN engineer units can provide support in areas such as bridging and construction.
- HN facilities. The use of existing HN facilities can relieve the engineer of the need for a great deal of construction. Contractual agreement can provide support in billets, maintenance shops, medical and dental clinics or hospitals, logistics activities, and recreational areas.
- Engineer supplies and equipment. The availability of critical supplies depends highly on the TOs. Such things as construction materials (lumber, bricks, concrete, asphalt), construction equipment

and tools, and obstacle materials will drastically reduce engineer lift requirements into the TOs. METT-T analysis determines the final decision to use HN assets and appropriate HNS C2 to support engineers. The following factors should be considered in determining the suitability of using HN resources to accomplish engineer missions and functions in the AOR:

- The effect on US security of failure to comply with a HN asset.
- The reliability of the HNS provided.
- The capability, dependability, and willingness of the HN to provide and sustain identified resource needs.
- The political, social, and economic considerations associated with using HN assets.
- The risk associated with HNS not being available in wartime in the type and quantity agreed on.

CAPTURED ENGINEER RESOURCES

Captured engineer resources may become available during operations. The engineer's use of captured obstacle and construction materials, mines and demolitions, and engineer equipment can significantly reduce logistics requirements in the AOR. Food, water, and medical supplies can be used to support EPW camps or holding facilities. Captured facilities can be used in a variety of ways to support logistics operations.

CONTINGENCY OPERATIONS SUPPORT

Contingency operations may require the same or greater level of logistics support to engineers as wartime operations. Combatant commanders tailor logistics support to engineers based on theater needs. In some cases, logistics-support units and engineers may be the only forces involved in the theater. The logistics operation may be the main effort in certain situations, such as in humanitarian-assistance operations. Logistics efforts are integrated with HN or local resources and activities. The wide variety of potential support requirements demands a flexible logistics structure tailored to theater missions. Engineers invariably get involved with a wide variety of missions that may need flexible logistics support. Critical engineer logistics considerations during contingency operations include availability of construction equipment, DS maintenance capability, repair-parts supply, and Class IV construction materials.

LOGISTICS SUPPORT FOR ENGINEER UNITS

Logistics elements at each echelon are organized to provide engineers with supply, maintenance, transportation, and field services. How the theater's logistics system supports a particular engineer unit depends on—

- That unit's organization.
- Its location in the TO.
- The command or support relationship under which it is operating.
- The maturity of the theater. The following paragraphs describe the logistics support to engineer units at each echelon:

ARMY SERVICE COMPONENT COMMANDER

Operational-level engineer units are supported by the ASCC's TAACOM subordinate ASGs. Other modular commands that may support engineers include personnel, transportation, finance, and medical commands. The ENCOM monitors logistics support to operational-level engineer forces.

JTF, JOINT FORCE LOGISTICS SUPPORT COMMAND (JFLSC), AND ARFOR

Engineer units assigned to a JTF, JFLSC, or ARFOR normally will be supported by an austere logistics-support structure. A JFLSC may be established to support all forces in theater until an ASCC TAACOM structure is required. The senior JTF, JFLSC, or ARFOR engineer HQ monitors logistics support to deployed engineer forces.

CORPS

The COSCOM supports corps engineer units. The COSCOM provides corps-level logistics support and health-services support to corps engineer units and operational-level engineer units attached to the corps. The division support command (DISCOM) supports corps units attached to the divisions. All other corps units operating in division areas receive logistics support from COSCOM units operating in nearby areas. The division's medical-support structure provides health-services support for corps units operating in division areas on an area basis. Operational-level engineer units working in the corps's area generally receive support for common classes of supply and common maintenance from the COSCOM. The corps engineer coordinates required logistics support for all engineer units working in the corps's area.

DIVISION

The DISCOM supports division engineer units. The DISCOM usually needs augmentation from the COSCOM to support corps engineer units attached to the division. In the heavy division, the forward support battalion (FSB) normally supports engineer equipment maintenance and Class IV and engineer Class V requirements. In light divisions, the main support battalion (MSB) supports engineer requirements. Nondivisional engineer units working in the division area generally receive support for common classes of supply and common maintenance from the DISCOM. The division engineer coordinates required logistics support for all engineer units working in the division area.

BRIGADE

The DISCOM forward support elements located in the BSA support the division engineers operating in the brigade's area. Nondivisional engineer units working in the brigade's area generally receive support for common classes of supply and common maintenance. The brigade engineer coordinates required logistics support for all engineer units working in the brigade's area.

COMMAND AND SUPPORT RELATIONSHIPS

Command and support relationships determine how engineer units will be sustained. This must be clearly stated during the planning phase of an operation and understood by all. Normally, maneuver units do not have the capability to logistically sustain nonorganic engineer units. These logistics considerations cause most engineers to be placed in an OPCON or DS role to maneuver forces. An engineer unit in OPCON, DS, or GS of another unit depends on its parent organization for sustainment. Parent engineer organizations track subordinate unit mission and status to allocate and provide sustainment resources properly.

Attaching engineer units to maneuver units or other units is rarely done because it requires the supported unit to provide logistics support except for personnel and administration activities. Command and support relationships can alter this to fit various situations. For example, the COSCOM could support operational-level engineers on a task in the corps's area. Corps engineers operating in a division's area could possibly receive support of common classes of supply and limited vehicle maintenance support from the DISCOM.

ENGINEER LOGISTICS CONCEPT

Engineer sustainment planners and executors focus on several essential tasks to accomplish the logistics support mission. They¯

- Keep pace with the operational decision cycle through early, complete, and continuous integration into the C2 and logistics structure.
- Plan and adjust engineer sustainment in concert with the rapid planning processes.
- Track subordinate and supporting engineer unit's sustainment postures so the sustainment planner can account for available resources, shift them as necessary, and integrate them into planning future operations.
- Influence, with detailed coordination from the logistics support units, current and future operations by ensuring that continuous and responsive logistics support is maintained

ENGINEER LOGISTICS LAYDOWN

Logistics support for engineer units depends on their location on the battlefield and their command or support relationship to the supported unit. In terms of logistics planning and integration, engineer units fall into the following types:

- ENCOM, engineer brigade, and engineer group¯headquarters and headquarters company (HHC) and separate engineer companies.
- Engineer units operating in division, separate brigade, and cavalry regiment areas.
- Engineer units supporting rear operations. Engineer HHCs and separate companies have limited organic capabilities to sustain themselves. Therefore, they rely on tailored logistics assets for sustainment throughout the battlefield. The engineer-unit sustainment planners locate and establish accounts with designated logistics-support agencies and units. Engineer separate companies that are attached to engineer battalions receive logistics support from those battalions.

Engineers organic to maneuver units establish accounts with and receive logistics support from the DISCOM, the separate brigade FSB, or the cavalry regimental support squadron (RSS). Corps and operational-level engineer units supporting divisions, separate brigades, and cavalry regiments receive support from corps and theater logistics packages. Special supply and health-service support packages from the corps and ASGs are tailored and sent to the DISCOM, BSA, and regimental support area (RSA). This action is done through direct coordination with the corps's or ASG's LO who is collocated with the DISCOM, FSB, or RSS CP.

Personnel service support remains with corps or theater personnel units that locate in the division support area (DSA), BSA, or RSA. Corps and operational-level engineer units operating in division rear areas receive supply and health-services support from DS corps support battalions. Personnel service support is obtained through direct coordination with corps and theater personnel units in the DSA.

GS engineer units operating in rear areas receive logistics support through a designated support group on an area basis. They locate and establish accounts with designated logistics-support agencies and units. Regardless of the command or support relationship and location on the battlefield, all engineer units provide routine logistics status reports through the appropriate HQ. They do this to ensure that the logistics support of engineer units is fully integrated into operational planning and coordination of sustainment support.

FLOW OF SUPPORT

Logistics support for engineer units is divided into two basic categories, unit sustainment and mission sustainment. The flow of supplies and services in these categories differs, requiring engineer logistics planners and executors to understand the differences. The requisition and delivery processes vary, based on the class of supply or type of service.

Unit Sustainment

Unit sustainment encompasses all of a unit's logistics-support requirements needed to remain a viable fighting force. Engineer unit sustainment is generally accomplished through the logistics-support battalions, personnel and medical units.

Mission Sustainment

Mission sustainment consists of the supplies and services needed to accomplish specific engineer missions. It requires supplies such as Class V demolitions and mines for combat operations and Class IV construction materials for general-engineering missions. These supplies are requested through the direct-support supply unit (DSSU), which in turn passes it to the MMC. These mission supplies are normally moved from corps and theater general-support supply units (GSSUs) by corps or theater transportation units as close to the combat or general-engineering mission location as possible. This minimizes multiple materiel-handling requirements, reduces transportation requirements, and facilitates faster mission accomplishment.

If mission-related supplies cannot be delivered directly to the combat or general-engineering location or engineer unit by corps or theater transportation assets, a plan using engineer or other assets is required.

Most engineer units are equipped to augment this operation with limited organic transportation capabilities, but they are not responsible for planning, controlling, and executing the delivery of mission-required supplies. Engineers can influence both unit and mission sustainment requirements through early integration into the sustainment planning process at various HQ CPs. Sound sustainment estimates, accurate tracking of engineer unit sustainment posture, and continuous coordination with the logistics planners ensure that engineer unit requirements are properly forecasted, prioritized, and delivered.

ENGINEER SUPPORT TO LOGISTICS OPERATIONS

The operational commander may task engineers to perform critical missions in support of logistics operations. The following paragraphs describe some of the common missions that engineers perform in support of logistics operations:

PERSPECTIVE:

In the Southwest Pacific, the 117th Engineer Battalion, 37th Infantry Division, consistently deployed its companies and platoons to build jeep trails and crude roads behind the advancing infantry. In the jungles and heavily vegetated hills of New Georgia, the infantry's front lines could only advance as fast as the engineers blazed the trails. This facilitated not only resupply but also evacuation of the wooded area as well. This became such a dominant mission for the battalion that the commander stopped deploying his companies in direct support of the infantry regimental combat teams. He retained control over all line companies and applied their efforts to the priority of tasks given to him by the division commander.

LOC CONSTRUCTION

LOC are often equated to MSRs, but they are much more. According to FM 100-5, LOC are all the routes (land, water, and air) that connect an operating military force with a base of operations and along which supplies and military forces move. Lines of support are intratheater extensions of LOC. If the theater's infrastructure is underdeveloped, engineer forces will need to arrive early in the force flow to establish the minimum required infrastructure to support the force. Establishing priorities of engineer effort will be crucial in the initial stages of force flow. Potential LOC engineering missions are

- Port construction or upgrade.
- Airfield construction, upgrade, or repair.
- MSR/alternate supply route construction, upgrade, or repair,
- Bridge construction, upgrade, or repair.

LOGISTICS-FACILITY CONSTRUCTION

Logistics operations require using facilities such as ASPs, POL bladder farms, supply points, and maintenance bays. Engineers may have to acquire these facilities or provide limited construction and prime-power electrical support to logistics facilities.

WATER-SUPPLY SUPPORT

Engineers may have to support in water detection and in developing water sources and water storage-and-distribution systems in the theater. Topographic-engineering support and water-detection teams from USACE assist in finding water sources. Well-drilling teams or contracted well-drilling support with organic logistics support develop water sources. Engineer tasks associated with water storage and distribution include preparing sites for storage tanks and bladders and constructing storage tanks and water-distribution lines, possibly by contract.

MEDICAL-FACILITY CONSTRUCTION

Constructing medical facilities may place one of the largest demands on engineers. Using existing HN facilities is preferred, but constructing adequate medical facilities may be needed to support the force.

Site-preparation requirements vary with the type of hospital and the nature of the terrain. Site selection may be restricted based on METT-T or political and social considerations. Whenever possible, the site selected should minimize the engineering construction effort. Theater real estate acquisition teams may be needed to lease the large amount of land required to support a health-services site. Follow-on medical-facility construction requirements include—

- Power generation and distribution.
- Waste disposal (hazardous and ordinary).
- Field sanitation.
- Water supply and distribution.
- Heating and cooling.
- Refrigeration.
- Patient and staff living facilities.

RECONSTITUTION SUPPORT

Reconstitution is an action that commanders plan and implement to restore units to a desired level of combat effectiveness commensurate with mission requirements and available resources. An operational pause may be necessary to implement reconstitution procedures. Often, engineers cannot take full advantage of reconstitution because many engineer missions continue to support the reconstitution effort, including MSR maintenance and airfield upgrades. Therefore, the engineer commanders emphasize the need for continuous internal reconstitution activities throughout the battle.

LOGISTICS FORCE-PROTECTION SUPPORT

Logistics forces are primarily located in rear areas and are vulnerable to rear-area threats. Rear-area operations are to secure the force, neutralize or defeat threat operations in the rear area, and ensure freedom of action in close and deep operations. Three levels of response to threat activities are used in planning rear operations. Rather than focusing on the size or type of threat, the following levels focus on the nature of friendly actions needed to defeat the threat:

- Level I threats can be defeated by base or base-cluster self-defense measures.

- Level II threats defeat are beyond base or base-cluster self-defense capabilities. However, they can be defeated by response forces, normally with supporting fires.
- Level III threats necessitate the command decision to commit a combined-arms tactical combat force to defeat them. Engineer construction forces build and fortify logistics bases, battle-command facilities, and decontamination sites. They also perform other engineer tasks needed against rear-area threats, such as camouflage and countermobility operations. Combat engineers can be used to defeat Level II threats if the maneuver commander deems it necessary to divert engineer assets to this mission. Generally, engineers are not suitable for defeating Level III threats unless they are augmented with additional forces, antiarmor weapon systems, and forward observer support that is adequate to defeat the expected threat forces.

KEY ENGINEER LOGISTICS LEADERS

Crucial to task accomplishment are the responsibilities of the engineer unit's key logistics leaders and their functions within the engineer CP systems. All engineer commanders and staffs must be familiar with and support these roles and functions to ensure appropriate engineer unit and mission sustainment.

Staff Engineer

The staff engineer, at all levels, is responsible for integrating engineer-specific information in orders and plans, including logistics support. He ensures that essential engineer logistics-support requirements are identified, coordinated, and published.

Executive Officer

Besides his second-in-command duties, the XO, from the engineer brigade through the engineer company—

- Integrates and synchronizes all logistics support in his unit.
- Directs the execution of engineer staff logistics-support tasks.
- Coordinates the effort of staff members.
- Supervises the efficient and prompt response of staff logistics-support functions.
- Relies on the logistics staff sections to plan, integrate, request, and monitor engineer logistics functions that support both unit and mission sustainment.

Adjutant (US Army) (S1)

The S1—

- Integrates personnel- and medical-service support and general administrative functions with the appropriate personnel- and medical-support unit.
- Should be cross-trained with the Supply Officer (US Army) (S4) in all areas of engineer sustainment.
- Coordinates engineer personnel and medical support.

Supply Officer (US Army)

The S4—

- Integrates the engineer's supply, maintenance, transportation, and field-services support with the appropriate logistics-support units.
- Should be fully cross-trained with the S1.
- Plans, coordinates, and monitors engineer operations with the logistics staff.
- Provides detailed sustainment input to the engineer CP for orders development for each mission.
- Monitors and tracks the sustainment status of engineer units.
- Is assisted by a chief supply sergeant, a supply technician warrant officer, and a supply specialist for supply-related functions.
- Is also assisted by a maintenance technician warrant officer and a senior maintenance supervisor for troubleshooting maintenance operations and support.

HHC Commander

ENCOM, engineer brigade, group, and battalion HHC commanders—

- Command the HHC's CP and are assisted by the HHC's first sergeant (1SG).
- Are responsible for coordinating sustainment of the ENCOM, engineer brigade, or group CP and command groups.
- Ensure logistics coordination and integration with designated logistics-support units.
- May also be responsible for base-defense operations.

Company 1SG

Engineer company 1SGs are the principal logistics executors at the company level. The company 1SG—

- Focuses on executing CSS functions in support of the current operations and coordinates future CSS operations.
- Establishes, moves, and leads the company trains (maintenance contact team, combat medics, fueler, and other CSS vehicles, as required).
- Links up with, in a combined-arms environment, the maneuver TF command sergeant major to coordinate mess, maintenance, medical, and casualty-evacuation procedures.
- Receives a battalion or TF LOGPAC at the logistics release point and escorts it to the company or various platoon locations to provide mess, maintenance, fuel, and personnel administrative services to company soldiers.
- Maintains close coordination with platoon sergeants, maintenance and supply section sergeants, support-platoon leaders, chaplains, and engineer battalion and maneuver TF S1s and S4s.
- Monitors the status of engineer company soldiers, including their health, welfare, and morale.

ENGINEER LOGISTICS C2

Each engineer CP has specific responsibilities in identifying unit and mission logistics requirements, estimating resources, integrating into the operational planning cycle, and monitoring the execution of engineer missions supporting logistics operations.

Rear CP Engineer Section

The rear CP engineer section—

- Is the engineer's primary integrator into rear CPs for executing logistics support for subordinate engineer units.
- Coordinates sustainment for current engineer operations and plans and prepares for implementing future operations.
- Maintains updated logistics status of engineer units.
- Provides the main CP engineer section with detailed logistics estimates to help formulate plans and orders.
- Ensures that engineer sustainment plans are synchronized with the logistics staff.

Main CP Engineer Section

The main CP engineer section—

- Develops engineer sustainment plans.
- Writes the engineer logistics portions of the basic OPLAN or OPORD and paragraph 4 of the engineer annex.
- Integrates engineer sustainment through coordination with the main CP logistics cells.
- Ensures that the immediate engineer sustainment requests received from the tactical CP or assault CP are forwarded to the rear CP.

Tactical or Assault CP Engineer Section

The tactical or assault CP engineer section has limited capability to impact engineer logistics support from this location. Its primary logistics duties are receiving and forwarding reports and influencing the redirection of sustainment priorities for forward operating engineer units.

Engineer Brigade and Group CSS Cells

The engineer brigade and group CSS cells—

- Support the brigade and group S1/S4 officers in developing the engineer sustainment plans and writing paragraph 4 for brigade and group OPORDs and OPLANs.
- Monitor current engineer logistics status through periodic personnel and logistics status reports

from subordinate units.

- Recommend logistics priorities to the brigade or group commander.
- Identify critical personnel and supply shortages, along with maintenance or transportation problems, that affect engineer unit and mission sustainment.
- Redirect logistics support. The engineer brigade CSS cell maintains constant communication with subordinate engineer units logistics sections, the rear CP engineer section, the SUPCOM CP, and the G4. The engineer group CSS cell maintains constant communication with the brigade CSS cell, the subordinate engineer units, and the supporting maneuver unit logistics support units, if required.

Engineer Brigade and Group HHC CPs

The engineer brigade and group HHC establish CPs at or near the brigade's or group's TOC. The HHC's CP is responsible for sustaining the brigade's and group's CP. This includes establishing accounts with designated logistics-support units, setting up life-support areas for CP personnel, and locating vehicle-maintenance areas. The HHC's CP may also be designated as a base-defense operations center (BDOC) or base-cluster operations center (BCOC).

Engineer Company Trains Element

Engineer companies may form a company trains element to control engineer logistics support or to establish an engineer equipment park or construction supply point. The company trains element—

- Is normally collocated with the company's CP.
- May be formed, depending on METT-T, near a supply or maintenance point or with an engineer battalion rear CP.
- Is under the control of the company 1SG.
- Consists of the company supply and maintenance sections.
- Tracks, reports, and provides critical engineer unit and mission sustainment support.
- Maintains constant communication with subordinate platoon and section sergeants, higher HQ logistics sections, designated logistics support units, and supporting maneuver unit logistics support units, if required.

ENGINEER'S ROLE IN PLANNING AND COORDINATING

The engineer's efforts to plan and coordinate engineer logistics efforts are essential to full integration of engineer units into the theater sustainment structure. All engineers and logisticians work closely to synchronize the logistics planning and coordination processes. They facilitate sound and timely plans or orders and necessary sustainment for engineer units.

After receiving a WO for a mission, the staff engineer immediately initiates an engineer logistics estimate. This estimate is specifically focused on sustaining all subordinate engineer units. Class I, III,

IV, and V supplies and personnel losses are the essential elements in the logistics estimate process. Close integration with the logistics staff can simplify and speed the estimate process by using their automatic data processing (ADP) systems. During continuous operations, the estimate process may need to be abbreviated due to time constraints. The staff engineer aggressively maintains an accurate logistics and combat status of all engineer units, which is critical to shortening the engineer logistics estimate process.

After conducting the estimate process to determine unit sustainment and mission supplies requirements, the staff engineer compares the requirements with the reported status of subordinate units to determine the specific amounts of supplies needed to support the operation. These requirements are then coordinated with thelogistics staff to ensure that necessary supplies are identified and resourced. At the same time, the staff engineer section develops a required supply rate (RSR) to support engineer mission requirements. Based on how much of the required items are on hand and how much will be needed, the staff engineer, in coordination with the logistics staff, assesses the availability of these supplies in stocks. They also analyze the capability to transport mission supplies to engineer units.

After identifying the requirements for unit sustainment and mission supplies and their availability, the staff engineer develops a projected engineer status, based on the current engineer sustainment status. The staff engineer then analyzes the requirements to support the plan and translates them into specific plans that are used to determine the supportability of COAs. After determining a COA, the specific engineer logistics input into the basic OPORD and paragraph 4 of the engineer annex are developed and incorporated into each. Current engineer sustainment operations may require redirection, based on the new plan. If so, the OPORD and engineer annex will be sent to subordinate engineer units for coordination and execution.

Engineer units provide unit and mission logistics status to the staff engineer so that he can do a similar logistics staff planning process. Accurate and timely status reporting assists the staff engineer in providing accurate engineer unit status to the commander. It also energizes the staff engineer support to intercede in critical sustainment problems when necessary. The staff engineer ensures that mission-required supplies needed by engineer units to execute missions are integrated into logistics plans.

CHAPTER 12

Contingency Operations

PERSPECTIVE:

During Operation Restore Hope, engineers built or repaired more than 1,100 kilometers of road. In some parts of the operational area, this effort constituted the center of gravity for humanitarian relief operations. The roads allowed relief organizations to reach outlying settlements and security forces to move to threatened spots. In one case, construction reduced travel time between two key cities from 26 to 12 hours. This effort included constructing two Bailey bridges and repairing a third bridge. One of these Baileys was built by light engineers.

Civic-action projects have always been a part of contingency operations. Such projects have included repairing schools, rehabilitating water wells, and clearing school yards and athletic fields. Work on farm-to-market roads provided the potential for economic growth, given maintaining these roads after the operation ended. However, civic action became one of the areas of mission creep. This is a condition in which certain projects arise that are beyond the scope of the mission statement. Because civic-action projects can be engineer-intensive, the JTF engineer had to limit programs outside the parameters of the mission statement to 50 hours. Included was the requirement to approve all materials used.

INTRODUCTION

Organizing and training for warfighting remains the primary mission of Army engineers. However, engineers can be called on to conduct contingency operations. The engineer commander and staff seek early identification of situations that may require committing engineers in contingency operations to facilitate planning and execution based on METT-T. Engineer force-projection planning includes the possibility that forces committed to contingency operations may become involved with combat operations. Engineers may conduct a wide variety of tasks in support of contingency operations, such as the following:

- Arms control.
- Attacks and raids.
- Combating terrorism.

- Disaster relief.
- Humanitarian assistance.
- Nation assistance.
- Support to insurgencies and counterinsurgencies.
- Noncombatant-evacuation operation (NEO).
- Peace operations.
- Rescue and recovery operations.
- Demonstrations and shows of force.
- Support to civil authorities.
- Support to counterdrug operations. All engineers cooperate fully with and act in support of federal, state, and local civil authorities during domestic contingency operations. Overseas, the engineer commander stresses a unified effort with joint and multinational forces and with the civil, military, and police agencies of the HN. The engineer ensures that the force is protected and secured in the AO by establishing effective intelligence networks to identify situational threats including man, nature, or both.

  An engineer unit may be designated as the force C2 HQ during contingency operations that require extensive engineer support such as disaster relief or nation-assistance operations. Other maneuver, CS, and CSS units may be attached or placed in support to the engineer unit during these contingency operations.

PRINCIPLES OF CONTINGENCY OPERATIONS

The doctrinally based principles of war such as mass, maneuver, unity of command, and surprise have withstood the tests of time and experience. However, they do not always apply to the conduct of activities other than warfare. The US forces have developed the following principles of contingency operations, for application, based on the mission and operational environment. Engineer considerations are also provided for each principle of contingency operations.

OBJECTIVE

During contingency operations, as in war, the engineer commander conducts a mission analysis that clearly defines attainable objectives for his unit. The obscure nature of contingency operations may require multiple tasks involved in a single mission. The military objective may be a national political or humanitarian objective. The objective may be limited. Success is usually measured against the stated mission; however, the operation could be expanded.

Engineers—

- Understand the goals and objectives of the higher HQ during contingency operations.
- Will be pressured to expand their missions because of unique equipment and personnel capabilities in support of contingency operations.
- Can help identify clearly defined operational objectives and end state through the use of mission and project completion times.

- Should avoid expanding their mission, unless accomplishing the additional tasks is critical to accomplishing the primary mission.

UNITY OF EFFORT

Unity of effort involves extensive coordination, cooperation, and liaison in the pursuit of common interests toward accomplishing the mission. This is done in the face of divergent goals and political interests. Unity of command may not be attainable during contingency operations. The environment may be multinational, interagency, or under another branch of government where a single chain of command does not exist. Therefore, the engineer commander attempts to obtain unity of effort. His primary task is consensus building and understanding each service, agency, and HN force capabilities and limitation as well as legal and political requirements and limitations.

Engineer commanders facilitate unity of effort by understanding and blending the various capabilities of military engineers and civilian contractors to meet mission requirements. Delineating engineer work areas helps avoid duplication of effort. The efficient use of engineers, equipment, construction materials, and repair parts increases force productivity.

LEGITIMACY

Legitimacy is the judgment that authority is being exercised by the right people in the proper way for correct purposes. Legitimacy during contingency operations involve—

- Legitimacy of the government or agency exercising authority.
- Legitimacy for the presence of US forces in the AO.
- Legitimacy in executing law-and-order operations. The people of the assisted nation, the world populace, and the US all perceive the legitimacy of the involvement of US forces differently. Their influence can determine the effectiveness of an operation if legitimacy is not established and maintained. Engineer contingency operations support certain political objectives. Their impacts affect how the HN and the US people perceive the host government and the US forces. Whenever possible, the commander ensures that his units enhance the legitimacy of the HN and its armed forces in the eyes of the people of that nation. In cases where a legitimate government does not exist, the commander uses caution when dealing with individuals or organizations to avoid unintended legitimization of those individuals or organizations.

  Engineers are well suited for enhancing the legitimacy of US presence during short- and long-term contingency operations. The visible construction and rehabilitation of public facilities, schools, water wells, and roads in support of the contingency-operation objectives enhance legitimacy of US forces in the eyes of the HN public. The presence of USACE and their contractors is well respected throughout the world as a legitimate US government agency.

PERSEVERANCE

The commander plans to achieve his contingency-operation objectives as rapidly as possible. However, many causes of conflict tend to be persistent and are not easily resolved in the near term. Conflict resolution is very time-consuming and may require a long-term commitment of US forces. All elements employed during contingency operations exercise adaptability, patience, determination, and perseverance

to continue the mission for as long as required.

Engineers persevere during contingency operations through versatility and agility to meet varied and quickly changing mission requirements. Units supporting maneuver forces with combat-engineering skills may have to construct logistics support facilities and structures on a moment's notice. Construction engineers may be required to breach urban obstacles with heavy equipment. Combat engineers may constantly breach land mines emplaced in the same stretch of road over many days and months. Maintaining supply routes with engineer equipment can become redundant in many contingency-operation scenarios. Engineers demonstrate perseverance and staying power through professionalism and technical and tactical competence in all assigned missions.

RESTRAINT

When the Army is committed to contingency operations, it will normally be constrained and limited by the terms of the mission statement, the terms of reference, and the rules of engagement (ROE), Restrictions on the type of force, weapons used, and ROE are established to prevent escalation of the violence in an activity. The commander refines the restraints and clearly communicates them to subordinate units.

Engineer forces operate fully within the restraints that the commander defines. The engineer staff will clearly establish and write the ROE concerning the use of land mines, demolitions, and protective emplacements. Constraints on the use of HN engineer equipment, laborers, and construction materials will also be identified.

SECURITY

All contingency operations contain some degree of risk; therefore commanders must secure their forces, regardless of mission. The presence of US forces will bring about a wide range of actions and reactions. Commanders must take appropriate measures to ensure that hostile factions, including terrorists and criminals, do not acquire an unexpected advantage. Seemingly benign situations may have elements that place soldiers at risk. A contingency-operation threat is not always easy to recognize. Mission restraints and ROE may limit response options. Friendly force dispersion, diverse activities, and nontraditional contingency-operations tasks make security for the force and the individual soldier difficult.

Engineers enhance contingency-operation security by understanding all ROE and mission constraints, securing their own forces at work sites and in base-camp locations, and providing force-protection construction support to the corps, such as building protective structures, digging emplacements, and emplacing barriers and barricades. Contingency-operations security also includes protecting the engineers through safe operation of their tools and equipment and by keeping the engineers safe and healthy.

ENGINEER SUPPORT TO CONTINGENCY OPERATIONS

Engineer support is fully integrated with the contingency-operations planning processes. Versatile

engineers provide unique personnel and equipment capabilities that can effectively support complex and sensitive situations in any contingency operation. All contingency operations relate directly to wartime corps engineer missions and tasks. In many cases, the only difference between a wartime and an engineer contingency operation is the threat level. The basic engineer tasks remain the same in both environments. FM 5-114 details engineers support to various contingency operations.

ARMS CONTROL

Arms control focuses on promoting strategic military stability. It encompasses any plan, arrangement, or process controlling the numbers, types, and performance characteristics of weapons, C2, logistics-support, and intelligence-gathering systems. Engineers may support arms-control operations by providing topographic and imagery products used to verify treaty compliance and by constructing logistics-support facilities involved with the arms-control process.

ATTACKS AND RAIDS

US forces conduct attacks and raids for specific purposes other than gaining or holding terrain. US forces conduct them to—

- Create situations that permit seizing and maintaining the political initiative.
- Place considerable pressure on governments and groups who support terrorism.
- Damage, destroy, or seize HVTs, equipment, or facilities that threaten national collective security interests.
- Demonstrate US capability and resolve to achieve a favorable result.
- Support counterdrug operations by destroying narcotics production or transshipment facilities or supporting HN activities in this arena. In support of attacks and raids, engineers construct rehearsal sites for the force involved in the operation. Topographic engineers produce large-scale photomaps or graphics to help guide forces to their objectives. Engineers participating in the mission may require refresher training in specialized skills, such as air-assault techniques, urbanized combat, or reorganization to fight as infantry. During attacks or raids, engineers may be tasked to—
- Protect flanks, withdrawal routes, and landing zones.
- Emplace and man roadblocks.
- Remove obstacles.
- Move or destroy captured equipment.
- Use captured equipment to perform missions.

COMBATING TERRORISM

Combating terrorism has two major components: antiterrorism (defensive) and counterterrorism (offensive). US forces combat terrorism mainly through antiterrorism, which include those active and passive measures taken to minimize vulnerabilities to terrorist attack. Antiterrorism is a form of force protection, which makes it the responsibility of all units and personnel. Counterterrorism is the full range of offensive operations against terrorists or those who support terrorists.

Engineers may become targets for terrorists because of how and where they perform their missions, especially construction projects and other wide-area missions. Equipment parks and supply yards are large and difficult to defend. Soldiers' operating equipment or hauling materials are vulnerable to ambush by fire, mines, and booby traps. In support of antiterrorism, engineer leaders—

- Develop a good IPB and EBA of threat forces.
- Establish and enforce sound operating procedures.
- Organize security elements.
- Construct secure life-support and CP areas.
- Construct protective shelters for key facilities.
- Emplace vehicle barriers.
- Clear standoff zones around facilities.
- Erect predetonation screens to protect units and installations.

PERSPECTIVE:

> In the early morning hours of 24 August 1992, Hurricane Andrew slammed into the southern tip of Florida. The eye of the hurricane passed directly over Homestead Air Force Base and the surrounding communities of Homestead and Florida City with an estimated wind speed of over 160 miles per hour (mph)... Late on 27 August 1992, the XVIII Airborne Corps was alerted and directed to send a logistical task force to aid in the relief operations. The 20th Engineer Brigade was directed to begin deployment of forces and have an airborne engineer battalion on the ground within 24 hours...During the time frame to deploy all military engineers, those units on the ground were busy with a varied amount of work. After the area's main roads were opened, debris operations became a lower priority mission. Clearing areas for establishing disaster-assistance centers (DACs), life-support centers (LSCs), mobile kitchen trailer (MKT) feeding sites and removing associated trash and refuse from those areas became priority tasks. Furthermore, clearing debris from schools grew in importance when local authorities decided to reopen them on 14 September 1992.

DISASTER RELIEF

US forces participate in disaster-relief operations to promote human welfare and to quickly reduce the loss of life, pain and suffering, and destruction of property as a result of a natural or man-made disaster. These operations may be a combination of joint, multinational, or interagency support. US forces continually coordinate and cooperate with local, state, federal, and nongovernmental agencies for timely response in the disaster area. Under the Federal Response Plan (FRP), USACE is the leading federal agency for planning and executing Emergency Support Function (ESF) #3. Engineer units deployed for and available to support state and local governments under the FRP will receive mission assignments for ESF #3 support from the supported USACE commander resulting from coordination between the JTF engineer and the USACE commander on the ground. See FM 100-19 for further details.

Engineers provide personnel and equipment capabilities that are extremely useful during disaster-relief operations in the following areas:

- Removing debris.

- Reestablishing utilities.
- Emergency restoration of public facilities and infrastructures.
- Flood fighting.
- Providing emergency power.
- Support to urban search and rescue.
- Building temporary facilities and structures for displaced persons.

HUMANITARIAN ASSISTANCE

US forces have the ability to respond rapidly to emergencies that are caused by natural or man-made disasters or other conditions such as human pain, disease, famine, or privation in specific countries or regions. The State Department approves most humanitarian assistance operations, and Congress funds them through specific appropriations. Commanders coordinate their efforts through the DOD, the US Agency for International Development (USAID), and the US ambassador. US forces—

- Can be tasked to provide the C2 support necessary to plan and execute the ground portion of any humanitarian- assistance operation.
- May be tasked to provide the logistics support necessary to relieve human suffering.
- May also be tasked to provide forces to secure an area to allow the humanitarian-relief efforts of other agencies to proceed. Engineer assistance may include—
- Constructing and repairing rudimentary surface transportation systems, basic sanitation facilities, and rudimentary public facilities and utilities.
- Drilling water wells.
- Constructing feeding centers.
- Disposing of human and hazardous wastes.

NATION ASSISTANCE

Nation assistance includes the civil and military-assistance actions (other than humanitarian assistance) that US forces render to a nation within that nation during war, conflict, and peace. Nation assistance supports the HN's efforts to promote development, ideally by using its own resources. The goals of nation assistance are to—

- Promote long-term stability.
- Develop sound and responsive democratic institutions.
- Develop a supportive infrastructure.
- Promote strong free-market economies.
- Provide an environment for orderly political change and economic progression. All US nation-assistance actions are integrated through the US ambassador's country plan and CINC's regional plan. These goals can only be met through the education and transfer of essential skills to the HN. To be effective in meeting these goals, the HN must develop a sense of ownership of nation-assistance actions and projects. Typical engineer missions in support of nation-assistance operations include—

- Engineer staff visits and exchanges of engineer subject-matter experts (SMEs) between the US and the foreign nation to discuss specific engineer topics.
- Exchange of engineer officers and noncommissioned officers (NCOs) to work in the HN's army.
- Deploying engineer units to perform multinational engineer training with the HN's military. This training may include constructing roads, airfields, structures, and ports; drilling wells; producing construction material; and providing topographic engineering.

SUPPORT TO AN INSURGENCY AND A COUNTERINSURGENCY

At the direction of the National Command Authority (NCA), US forces may assist either insurgent movements or the HN government opposing an insurgency. In both cases, the corps predominately supports political and economical objectives. Through special operating forces (SOFs), US forces covertly support insurgencies that oppose repressive regimes that work against US interests. US forces provide overt support to a HN's counterinsurgency operations through logistics and training support in concert with the US ambassador's country plan.

Engineer support to insurgency forces is limited to providing topographic products and construction of SOF operating bases located outside the AO. Engineer missions for counterinsurgency operations are similar to those for humanitarian and nation assistance: water supply and sanitation improvements; road, airfield, and port construction; and multinational training.

NONCOMBATANT-EVACUATION OPERATIONS

NEOs are conducted to evacuate threatened US and authorized HN or third-country citizens from locations in a foreign nation or unsafe haven. NEOs involve swift, temporary occupancy of an objective. They end with a preplanned withdrawal. If the use of force is involved, the minimum amount of force to accomplish the mission will be used. A NEO is normally conducted as a joint operation by US forces; sometimes it involves multinational forces. Army Regulation (AR) 525-12 outlines responsibilities, policies, and procedures for planning and conducting a NEO.

Engineers that support a NEO generally operate as part of a joint force and may conduct a wide variety of tasks, such as

- Constructing temporary facilities and protective structures in country or in another country for either US forces or the evacuees.
- Providing needed topographic products and data for the operation.
- Conducting route reconnaissance and mobility operations for land evacuation.
- Repairing airfields and clearing helicopter landing zones for use in air-evacuation operations.

PEACE OPERATIONS

Peace operations encompass three types of activities: support to diplomacy, peacekeeping operations, and peace-enforcement operations (PEOs).

Support to Diplomacy

Military support to diplomacy has become increasingly important in furthering US interests abroad. Its components include peacemaking, peace building, and preventive diplomacy. See FM 100-23 for further details.

Engineer involvement in support to diplomacy may include shows of force, preventive deployments, military-to-military relations, security-assistance programs, construction projects, and repairing utilities and roads.

Peacekeeping Operations

A PKO supports diplomatic efforts to establish or maintain peace in areas of potential or actual conflict. They are undertaken by the consent of all belligerents. US PKO forces monitor and facilitate implementing an existing truce or cease-fire and support diplomatic efforts to reach a long-term political settlement. Strict appearance of neutrality, adequate means of self-protection, and the availability of timely and effective support are critical. US forces may be tasked to conduct a PKO over a considerable time period, under multinational control, such as the UN, or under a unilateral peacekeeping umbrella.

Engineers participate in PKOs by constructing and maintaining roads, airfields, landing zones, ports, pipelines, and other associated missions such as land mine detection and removal.

Peace-Enforcement Operations

PEOs are military intervention operations that support diplomatic efforts to restore peace or to establish conditions for conducting PKOs. PEOs—

- Are intended to halt violence and restore more normal civil activities.
- Seek to restore order and political and diplomatic dialogue.
- Do not require the consent of all belligerents. Typically, one or more of the belligerents will not be in favor of the employment of PEO forces. When conducting a PEO, US forces deploy sufficient combat power to present a credible threat, protect the force, and conduct the full range of combat operations necessary to restore order and separate warring factions when required. A PEO will normally be conducted in cooperation with other countries and agencies, but may be unilateral in scope. Engineers support a PEO based on METT-T with—
- Combat-engineer missions in support of combat operations.
- Topographic-engineering support.
- Lodgment and theater infrastructure development, to include constructing and repairing protective facilities, roads, airfields, ports, and troop life-support facilities.

RESCUE-AND-RECOVERY OPERATIONS

Rescue-and-recovery operations involve locating, identifying, and extracting friendly, hostile, and/or neutral personnel, sensitive equipment, and/or items critical to US national security.
Rescue-and-recovery operations may be opposed by hostile forces and require extensive planning and rehearsals to achieve precise execution. US forces normally conduct rescue-and-recovery operations in an overt nature, similar to offensive operations.

Engineer support of rescue-and-recovery operations is focused on providing required topographic

products and constructing rehearsal areas and facilities. Specialized engineer skills, such as demolition, may be required.

DEMONSTRATIONS AND SHOWS OF FORCE

Demonstrations and shows of force portrayto potential adversaries the American resolve in a situation vital to our national interests. They can take the form of multinational training exercises, rehearsals, forward staging of units, or the buildup of forces in the AO. US involvement in a show of force may range in size and scope from a publicized heightened state of alert at the home station to completing an unopposed force-projection entry into the AO. The possibility of a show of force deteriorating into combat operations must be planned for. Political concerns dominate a show of force.

Engineer support to demonstrations and shows of force will normally be a joint and multinational effort. Engineer tasks are very similar to those described in Chapter 3. Overt use of engineers during shows of force may aid in the political intent of the operation.

SUPPORT TO CIVIL AUTHORITIES

These operations provide temporary support to domestic civil authorities when permitted by law. They are normally taken when an emergency overwhelms the capabilities of civil authorities. The type of support that the corps provides is divided into four categories: disaster relief, environmental assistance, community assistance, and law-enforcement support.

Engineers may be called on to support civil authorities in various missions such as fighting forest fires, removing snow, removing hazardous wastes, controlling riots, and constructing emergency bridges and airfields. FM 100-19 details how engineers support civil authorities.

SUPPORT TO COUNTERDRUG OPERATIONS

Because of US code restrictions, US forces do not normally participate in domestic counterdrug operations. National guard units may participate in counterdrug operations while under state control. US forces may become involved in cooperating with foreign governments to interdict the flow of illegal drugs at the source, in transit, and during distribution. US support of foreign counterdrug operations is normally coordinated by the CINC of the region, his special operations command, and country military assistance groups. US forces will normally supervise the preparation, deployment, and possible sustainment of small specialized units to meet CINC or special operations forces shortfalls.

Engineers supporting domestic counterdrug operations perform missions focused on supporting local law-enforcement agencies. Engineers are sensitive to the legal aspects of support to civilian authorities and abide by the Posse Comitatus Act. They are also aware of the capabilities of the threat, primarily heavily armed narcotics traffickers. Typical support tasks include—

- Constructing or rehabilitating law-enforcement target ranges; helipads; and fuel-storage, billet, CP, and maintenance facilities.
- Producing photomaps and other topographic products of likely counterdrug operations areas.
- Constructing or upgrading access roads for drug-interdiction patrols.
- Clearing observation fields for counterdrug teams.

ENGINEER CONSIDERATIONS FOR CONTINGENCY OPERATIONS

Contingency operations are joint, multiagency, and multinational efforts. Effective engineer liaison with all involved military units and civilian agencies is critical to successful contingency operations. The engineer commander tailors engineer support based on contingency-operations requirements and may be radically different than for supporting combat operations. The following paragraphs highlight key engineer contingency-operations considerations:

ENGINEER ASSESSMENT

An early, on-the-ground assessment by engineers is absolutely critical to tailor properly and to support logistically the follow-on engineer contingency-operations force. Results of this assessment are quickly passed to deployment planners to ensure that an adequate engineer support force arrives in the AO in a timely manner. The failure to provide these engineers may cause inadequate troop bed down, sanitation, and force protection to the deployed force. This early, on-the-ground engineer assessment identifies the—

- Threat engineer capabilities in likely lodgment areas, to include combat-engineering requirements for force-protection, countermine, counterobstacle and early entry force-support operations.
- Status of the infrastructure in the AO, to include airfields, roads, ports, logistics bases, and troop bed-down facilities; real estate acquisition; construction material supply; construction management; and line haul requirements.
- Existing topographic product availability and requirements for new terrain visualization products.
- Specialized engineer requirements such as prime-power, well-drilling, and fire-fighting support.
- Engineer C2 requirements, including HQ staffing, communications, and information systems support.
- Engineer liaison requirements, including linguists and civil-affairs personnel.
- Mission objectives and end-state, mission-success, and liaison procedures.
- Requirements for officers with COR or USACE experience.
- Use of LOGCAP, contractor responsibilities, contract-construction procedures, and initial work areas.

JOINT ENGINEER C2

Because of the joint, multiagency, and multinational nature of contingency opertations, how to command and control the various engineers is a key consideration. At the joint and multinational staffing levels, the engineer staff should be placed under the Operations Directorate (J3) or as a separate staff engineer section. Engineers should avoid being placed under the auspices of the joint or multinational Logistics Directorate (J4). Lessons learned from continuing contingency-operations deployments show that when staff engineers are placed under the J4, they are tied up supporting logistics forces in theater, at the expense of maneuver and other deployed units. A separate engineer HQ should be identified to command and control the varied, critical, and constrained contingency-operations engineer support.

TOPOGRAPHIC SUPPORT

By their nature, contingency operations are normally conducted in areas of the US and the rest of the world that have limited up-to-date topographic coverage from the DMA and US Geological Survey (USGS) and other civilian, allied, and HN sources. When providing topographic support to a JTF or ARFOR contingency operation, the engineer must consider—

- Evaluating the availability of standard and nonstandard map products in the contingency operation's AO. If shortfalls exist, he and the Intelligence Directorate (J2) or ARFOR G2 define specific requirements and coordinate the collection and creation of necessary data to build the JTF or ARFOR topographic data base.
- Coordinating with the J2/J3 or ARFOR G2/G3 for early collection of terrain information in the contingency operations' AO through reconnaissance, topographic survey, and satellite imagery.
- Ensuring that terrain analysis and topographic reproduction capabilities are available to the JTF or ARFOR early in the contingency operations' AO or through split-basing capabilities from CONUS locations.
- Establishing a topographic product storage and distribution capability in the contingency operations' AO, in conjunction with the J4 or ARFOR G4.
- Establishing special topographic-product procedures with special operations forces and other deployed forces.

CONSTRUCTION SUPPORT

Contingency operations are normally conducted after an area's infrastructure has been destroyed because of man-made or natural disasters or conflicts between warring factions. Contingency operations require engineers to establish some type of bare-base infrastructure that supports deployed forces or displaced civilians with minimal life-support and a protected, healthy, and safe environment. In a contingency-operation atmosphere—

- Sanitary living and working areas are usually nonexistent.
- Water supplies are usually contaminated.
- Electric power grids are normally off-line.
- Airfields and ports may not be operating at full capacity due to damage.
- Criminal activity may be widespread. When providing construction support to a corps JTF or ARFOR contingency operation, the engineer must consider—
- Determining the status and availability of existing infrastructure facilities, utilities, airfields, ports, roads, and construction materials in the contingency operation's AO.
- Estimating minimal engineer construction standards for life support and force protection, including the need for base-camp packaging.
- Defining the construction end state with the JTF or ARFOR commander.
- Avoiding mission creep.
- Determining what construction that US or HN military engineers or civilian contracting through LOGCAP will conduct, based on deployment time lines and threat level.

- Ensuring that the JTF or ARFOR has adequate construction-management capability in the contingency operation's AO, including the use of joint, ENCOM, or USACE augmentation teams.
- Establishing real estate acquisition policies and programs in the contingency operation's AO.
- Ensuring that real estate acquisition teams are deployed.
- Conducting a thorough terrain analysis to ensure adequate construction-site drainage, heavy equipment access, and protection.
- Ensuring that required construction materials are procured and shipped in a timely manner to meet initial deployed force-protection and life-support needs.
- Ensuring that construction materials arrive with deploying forces.
- Establishing specific construction-material yard locations and requisition and distribution procedures with the JTF J4 or the ARFOR G4.

COUNTERMINE OPERATIONS

Estimates indicate that there are more than 100 million uncleared land mines spread throughout 62 countries. This equates to about one land mine for every 50 people on our planet. Land mines¯

- Are cheap.
- Are obtained or constructed easily.
- Have become the third world's weapon of choice.
- Threaten civilian populations and US forces during contingency operations. The engineer must consider the following when providing countermine support to a corps JTF or ARFOR contingency operation that is threatened with land mines:
- Working closely with the JTF J2 or ARFOR G2 to determine the land mine threat in the contingency operation's AO.
- Publishing mine-recognition handbooks for deploying forces.
- Exploiting all sources of intelligence to identify mined areas in the contingency operation's AO.
- Ensuring that deployed forces are trained to identify, mark, and report encountered land mines.
- Ensuring that engineers are fully confident in employing countermine equipment and that the equipment is operational.
- Conducting land-mine detection, marking, and removal training for soldiers conducting countermine missions.
- Providing necessary individual protective equipment and mine resistant vehicles to soldiers conducting countermine operations.
- Establishing, disseminating, and enforcing route and area land-mine clearance and marking procedures for the contingency operation's AO. These procedures should be included with established ROE.

PERSPECTIVE:

Army engineers built six 500-man base camps in Somalia during Operation Restore Hope. Facilities, in general, were both temporary and permanent. One of the considerations was

providing force-sustainment facilities for follow-on UN peacekeeping forces in addition to current demands. This included drilling wells, building showers and latrines, contracting for laundry services, and so forth. However, initial units deployed with minimal Class IV and little engineer equipment due to aircraft limitations. In addition, there was limited Class IV material on pre-positioned ships. This limited the timely construction of support facilities and created a force-protection problem due to inadequate obstacle materials.

FORCE PROTECTION

Commanders and staff planners must not neglect force protection. The HN may provide security forces, US forces (usually military police or infantry) may augment security forces, or a combination of the two may occur. If the later occurs, all of the involved units and agencies will have to closely coordinate their mission plans. Contingency opertions normally indicate a low threat level; however, that threat is a significant concern to deployed forces. Hostile elements, with the initiative and in their own environment, can gain a great deal with minimal effort.

Engineer units on construction missions could fail due to a loss of essential equipment or personnel casualties. Therefore, physical and personnel security must be considered at every level of planning. See FM 5-114, Appendix A, for a detailed discussion on force-protection measures.

Engineers have unique equipment and personnel capabilities that can be used to support deployed force-protection efforts during contingency operations. Engineers construct protective facilities, bunkers, emplacements, vehicle barriers, fences, and other structures needed to protect the force. When providing force-protection support to a corps's JTF or ARFOR's contingency operation, engineers must consider–

- Establishing the required level of protection needed in the contingency operation's AO, based on the expected threat, with the JTF or ARFOR commander.
- Developing force-protection construction standards for operating and life-support bases, including the need for security fencing, lighting, obstacles, and guard posts.
- Ensuring that early entry forces have adequate force-protection construction materials.
- Establishing facility security-inspection procedures with military and local law-enforcement personnel to quickly identify and repair breaches.

APPENDIX A

Engineer Organizations and Functions

ENGINEER OPERATIONS

Engineers conduct their battlefield functions throughout the TO, from the forward line of own troops (FLOT) through the COMMZ to the airports or seaports of entry. Engineers do not fight alone. They are an important part of the combined-arms team, and their battlefield functions increase the team's combat effectiveness.

The engineer force structure has been developed to support various missions from front to rear, with more survivable and mobile forces in the forward CZ. Any engineer unit could find itself pushed forward, if the mission dictates.

A wide variety of engineer units provides particular technical capabilities required to accomplish essential, diversified tasks throughout the depth of the theater. The engineer architecture forms these units into an organization that is responsive to commanders at all echelons. This appendix addresses engineer organizations at division, corps, and operational level.

DIVISION ENGINEER UNITS

HEADQUARTERS AND HEADQUARTERS DETACHMENT (HHD), ENGINEER BRIGADE, HEAVY DIVISION

The HHD, engineer brigade, heavy division—

- Provides C2 of, staff planning for, and supervision of engineer units that are assigned, attached, or supporting units engaged in M/CM/S, general-, and topographic-engineering tasks.
- Advises the division commander and staff on engineer operations and the impacts on division operations.
- Plans and coordinates engineer operations for the units that are constructing tactical obstacles, defensive positions, and fixed and floating bridges; breaching or clearing obstacles; and

conducting river-crossing operations.

ENGINEER COMBAT BATTALION, HEAVY DIVISION

Three engineer combat battalions are organic to an engineer brigade, heavy division. Each battalion consists of one HHC and three line companies. This battalion increases the combat effectiveness of a division by accomplishing M/CM/S and limited general-engineering tasks; it may fight as infantry when required. Special capabilities of this battalion include, but are not limited to—

- Emplacing and maintaining assault bridges to span twelve 60-foot gaps simultaneously.
- Conducting breaching operations.
- Constructing tactical obstacles and defensive positions.
- Performing expedient repair of essential combat trails, bridges, fords, and roads in the brigade area.

ENGINEER COMBAT BATTALION, ENHANCED HEAVY SEPARATE BRIGADE

One engineer combat battalion is organic to a maneuver-enhanced (armor/mechanized), heavy separate brigade. A battalion consists of one HHC and three line companies. This battalion increases the combat effectiveness of an enhanced heavy separate brigade by accomplishing M/CM/S and limited general-engineering tasks; it may fight as infantry when required. Special capabilities of this battalion include, but are not limited to—

- Emplacing and maintaining assault bridges to span twelve 60-foot gaps simultaneously.
- Conducting breaching operations.
- Constructing tactical obstacles and defensive positions.
- Performing expedient repair of essential combat trails, bridges, fords, and roads in the brigade area.

LIGHT ENGINEER DIVISIONAL ORGANIZATIONS

ENGINEER BATTALION, AIRBORNE DIVISION

Organic to an airborne division, this battalion consists of one HHC and three line companies. It increases the combat effectiveness of an airborne division by accomplishing M/CM/S tasks; it may fight as infantry when required. This unit—

- Prepares and maintains expedient combat routes in the forward battle area, to include ingressing and egressing to block positions and river-crossing sites and expedient repair of essential bridges, fords, and culverts.
- Assists in assaulting fortified positions.
- Constructs tactical obstacles.
- Conducts breaching operations.

ENGINEER BATTALION, AIR-ASSAULT DIVISION

Organic to an air-assault division, this battalion consists of one HHC and three line companies. It increases the combat effectiveness of an air-assault division by accomplishing M/CM/S tasks; it may fight as infantry when required. This unit—

- Prepares and maintains expedient combat routes in the forward battle area, to include ingressing and egressing to block positions and river-crossing sites and expedient repair of essential bridges, fords, and culverts.
- Assists in assaulting fortified positions.
- Constructs tactical obstacles.
- Conducts breaching operations.

ENGINEER BATTALION, LIGHT INFANTRY DIVISION

Organic to a light infantry division, this battalion consists of one HHC and three line companies. It increases the combat effectiveness of a light infantry division by accomplishing M/CM/S tasks; it may fight as infantry when required. This unit—

- Prepares and maintains expedient combat routes in the forward battle area, to include ingressing and egressing to block positions and river-crossing sites and expedient repair of essential bridges, fords, and culverts.
- Assists in assaulting fortified positions.
- Assists maneuver forces in the assault breach of obstacles and minefields.
- Constructs tactical obstacles.
- Conducts breaching operations.

SEPARATE COMPANIES

ENGINEER COMPANY, LIGHT ARMORED CAVALRY REGIMENT

Organic to a light armored cavalry regiment, this company will increase the combat effectiveness of a light armored cavalry regiment by accomplishing M/CM/S and limited general-engineering tasks; it may fight as infantry when required. This unit—

- Provides limited combat-engineer capability to support one cavalry squadron.
- Advises the maneuver commander on engineer-unit capabilities and the impact on the maneuver plan.
- Prepares and maintains combat trails in forward areas; repairs essential bridges, fords, and roads expediently; conducts breaching operations; constructs tactical obstacles and defensive positions.

ENGINEER COMPANY, ARMORED CAVALRY REGIMENT

Organic to an armored cavalry regiment, this company will increase the combat effectiveness of an armored cavalry regiment by accomplishing M/CM/S and limited general-engineering tasks; it may fight as infantry when required. The engineer company—

- Advises the maneuver commander on engineer-unit capabilities and the impact on the maneuver plan.
- Prepares and maintains essential combat trails in forward areas.
- Conducts expedient repair of essential bridges, fords, and roads.
- Provides, emplaces, and maintains assault bridges to span six 60-foot gaps simultaneously.
- Constructs tactical obstacles, defensive positions, and fixed and floating bridges.
- Conducts breaching operations and assault river-crossing operations.
- Constructs, repairs, and maintains CPs, combat trails, site damages, chemical-decontamination sites, and logistics field sites.

ENGINEER COMPANY, HEAVY SEPARATE BRIGADE

Organic to a heavy separate brigade, this company will increase the combat effectiveness of a heavy separate brigade by accomplishing M/CM/S and limited general-engineering tasks; it may fight as infantry when required. The engineer company—

- Advises the maneuver commander on engineer-unit capabilities and the impact on the maneuver plan.
- Prepares and maintains essential combat trails in forward areas.
- Conducts expedient repair of essential bridges, fords, and roads.
- Provides, emplaces, and maintains assault bridges to span six 60-foot gaps simultaneously.
- Constructs tactical obstacles, defensive positions, and fixed and floating bridges.
- Conducts breaching operations and assault river-crossing operations.
- Constructs, repairs, and maintains CPs, combat trails, damaged sites, chemical-decontamination sites, and logistics field sites.

ENGINEER COMPANY, SEPARATE INFANTRY BRIGADE

Organic to a separate infantry brigade, this company increases the combat effectiveness of a separate infantry brigade by accomplishing M/CM/S and general-engineering tasks; it may fight as infantry when required. The engineer company—

- Advises the brigade commander, his staff, and other maneuver commanders on allocating engineer resources and capabilities available to assist in accomplishing the unit's missions.
- Prepares and maintains essential combat routes in the brigade area to include ingressing and egressing to block positions and river-crossing sites and expedient repair of essential bridges, fords, and culverts.
- Assists in assaulting fortified positions.

- Conducts breaching operations.

SEPARATE TEAMS

TOPOGRAPHIC TERRAIN DS TEAM, HEAVY DIVISION

Organic to a heavy division, this team normally is collocated with the G3/G2 planning and operations staff. It provides staff advice and assistance to a supported division and control of terrain analysis teams (heavy) in DS of topographic missions.

TOPOGRAPHIC TERRAIN ANALYSIS TEAM, HEAVY DIVISION

Organic to a heavy division, this team—

- Produces terrain intelligence for a heavy division.
- Provides qualified personnel who collect, evaluate, and disseminate terrain data.
- Analyzes the effects of terrain on military operations.
- Advises the supported commander on all terrain-related matters.

TOPOGRAPHIC TERRAIN ANALYSIS TEAM, LIGHT DIVISION

Organic to a light division, this team—

- Produces terrain intelligence for a light division.
- Provides qualified personnel who collect, evaluate, and disseminate terrain data.
- Analyzes the effects of terrain on military operations.
- Advises the supported commander on all terrain-related matters.

CORPS ENGINEER UNITS

ENGINEER BRIGADE, CORPS

The engineer brigade, corps—

- Commands and controls assigned and attached engineer organizations
- Plans and coordinates the operations of engineer units engaged in CS, construction, and rehabilitation of facilities in support of a corps or airborne corps.
- Provides staff planning and supervision and allocates engineer units and resources to support engineer operations.
- Plans and supervises activities relating to river-crossing, barrier-placement, and counterobstacle and countermine operations.
- Supervises engineer units that construct and rehabilitate roads, combat roads and trails, structures, air-landing facilities, and petroleum-storage facilities.
- Supervises contract construction, labor, and indigenous personnel.

- Provides an engineer staff element to corps HQ.
- Plans and supervises terrain intelligence and topographic operations.

ENGINEER GROUP, COMBAT

This engineer group is attached to an engineer brigade, corps. The group—

- Commands and controls assigned and attached engineer combat battalions and assigned engineer companies.
- Commands and controls three to seven combat battalions assigned in the corps's area.
- Plans, supervises, and coordinates the activities of engineer units engaged in M/CM/S and general-engineering tasks.
- Supervises those engineer units that prepare and maintain combat routes and MSRs and construct and repair landing strips, heliports, port facilities, and railroads in the corps's operations.

ENGINEER COMBAT BATTALION, CORPS WHEELED

This battalion is normally assigned to a combat group HQ. The number of wheeled battalions allocated is based on the number and type of divisions allocated to a corps. An engineer combat battalion consists of one HHC and three line companies. This battalion—

- Increases the combat effectiveness of a corps by accomplishing M/CM/S and limited general-engineering tasks.
- May fight as infantry when required.
- Reinforces engineer divisional units when required.
- Participates in joint military operations.
- Provides C2 and staff supervision for assigned and attached units.
- Constructs tactical obstacles and defensive positions.
- Employs fixed and floating bridges.
- Constructs, repairs, and maintains landing strips, heliports, CPs, LOC and tactical routes, culverts, fords, and other horizontal-construction-related tasks.
- Conducts limited breaching operations.
- Provides engineer support in river-crossing operations.

ENGINEER COMBAT BATTALION, CORPS MECHANIZED

Normally assigned to a combat group HQ, this battalion consists of one HHC and three line companies. The number of mechanized battalions allocated is based on the number of heavy divisions allocated to a corps. This battalion—

- Increases the combat effectiveness of a corps by accomplishing M/CM/S and limited general-engineering tasks.
- May fight as infantry when required.
- Reinforces engineer heavy divisional units, heavy separate brigades, and armored cavalry regiment

engineer units.

- Provides C2 for assigned and attached units.
- Constructs tactical obstacles, defensive positions, and fixed and floating bridges.
- Emplaces and maintains assault bridges to span twelve 60-foot gaps simultaneously.
- Constructs, repairs, and maintains landing strips, heliports, CPs, LOC and tactical routes, culverts, fords, and other horizontal construction-related tasks.
- Conducts breaching and river-crossing operations.

ENGINEER COMBAT BATTALION, CORPS AIRBORNE

Normally assigned to a combat group HQ supporting an airborne corps, this battalion consists of one HHC and three line companies; two battalions will support one airborne division. This battalion—

- Increases the combat effectiveness of a corps by accomplishing M/CM/S and limited general-engineering tasks.
- May fight as infantry when required.
- Reinforces engineer divisional units when required.
- Participates in joint military operations.
- Provides C2 and staff supervision for assigned and attached units.
- Provides engineer support in constructing obstacles, defensive positions, and fixed and floating bridges.
- Constructs and repairs CPs, LOC and tactical routes, culverts, fords, and other horizontal and vertical construction-related tasks.
- Constructs medium-lift, forward-area airstrips and support-area, tactical airstrips
- Performs expedient repairs of existing airfields and airstrips.
- Assists in assaulting fortified positions and breaching obstacles.
- Provides engineer support in river-crossing operations.

ENGINEER COMBAT BATTALION, CORPS LIGHT

Normally assigned to a combat group HQ, this battalion consists of one HHC and three line companies and will normally support one light division. The battalion—

- Increases the combat effectiveness of a corps by accomplishing M/CM/S and limited general-engineering tasks.
- May fight as infantry when required.
- Reinforces engineer divisional units when required.
- Participates in joint military operations.
- Provides C2 and staff supervision for assigned and attached units.
- Provides engineer support in constructing obstacles, defensive positions, and fixed and floating bridges.
- Constructs and repairs CPs, LOC and tactical routes, culverts, fords, and other horizontal and

vertical construction-related tasks.

- Constructs medium-lift, forward-area airstrips and support-area, tactical airstrips.
- Performs expedient repairs of existing airfields and airstrips.
- Assists in assaulting fortified positions and breaching obstacles.
- Provides engineer support in river-crossing operations.

ENGINEER COMBAT BATTALION, HEAVY

Assigned to corps, based on one battalion per division, and at the operational level, based on the number of battalions per work-load-driven requirement, this battalion consists of one HQ and support company and three line companies. The battalion—

- Increases the combat effectiveness of division, corps, and TA forces by accomplishing M/CM/S and limited general-engineering tasks.
- Constructs, rehabilitates, repairs, maintains, and modifies landing strips, airfields, CPs, MSRs, supply installations, building structures, bridges, and other related structures as required, normally to the rear of the division.
- Repairs and, on a limited basis, reconstructs railroads and sewage and water facilities.
- Supervises skilled labor and unskilled indigenous personnel.
- Constructs protective obstacles to degrade enemy mobility in rear areas.
- Clears obstacles as part of an area-clearance operations but not as part of an assault-breaching operations.
- Provides bituminous paving operations and quarrying and crushing operations, rehabilitates ports, constructs petroleum pipelines and storage facilities, distributes power, and restores and constructs major airfields, when specialized personnel and equipment are attached.

SEPARATE CORPS COMPANIES

ENGINEER COMBAT-SUPPORT EQUIPMENT COMPANY

Normally assigned to corps, the number of companies allocated is based on the number of combat wheeled and mechanized battalions assigned in the corps's AO. This company—

- Supports engineer combat operations by accomplishing general-engineering tasks.
- Performs survivability and countermobility tasks; general engineering along MSRs and combat trails in other corps close-operation areas; and general-engineering, survivability, and countermobility operations in a corps area. The engineer construction equipment personnel assigned construct, rehabilitate, repair, maintain, and modify landing strips, airfields, CPs, MSRs, and LOC.

ENGINEER COMPANY LIGHT EQUIPMENT, AIRBORNE

Normally assigned to corps, this company is usually aligned with the engineer combat battalion, corps, airborne. The company—

- Augments engineer operations with the capabilities to support airborne operations with engineer equipment that is downsized and rapidly deployable.
- Provides earth-moving equipment to support survivability and general-engineering missions.
- Provides a cross-country dump-truck capability of about 50 cubic yards or 45 tons per lift.
- Works with the airborne engineer battalions in early deployment with force-projection forces to establish forward logistics bases until the heavier corps and theater engineer assets arrive.

ENGINEER COMPANY LIGHT EQUIPMENT, AIR ASSAULT/LIGHT

Normally assigned to corps, this company is aligned with the engineer combat battalion, corps, air assault/light. The company—

- Augments engineer operations with the capabilities to support air-assault/light operations with engineer equipment that is downsized and rapidly deployable.
- Provides earth-moving equipment to support survivability and general-engineering missions.
- Provides a cross-country dump-truck capability of about 50 cubic yards or 45 tons per lift.
- Works with the air-assault/light engineer battalions in early deployment with force-projection forces to establish forward logistics bases until the heavier corps and theater engineer assets arrive.

ENGINEER MGB COMPANY

Normally assigned to corps, the number of MGB companies authorized within a corps is based on the number of assigned light/heavy divisions. This company—

- Provides personnel and equipment to transport, assemble, disassemble, and maintain bridging.
- Has four MGB sets with sufficient components to assemble various spans and load classes. Normally, these sets provide four 31.5-meter Class 60 bridges or two 49.6-meter Class 60 bridges with reinforcement kits.
- Provides technical supervision to assist other engineer units in bridge assembly and disassembly.
- Provides personnel and equipment to load, transport, and advise how to erect the panel-bridging equipment when required.
- Has 5-ton trucks, with a 150-ton capacity per trip, for earth-moving and general-engineering cargo hauling, when bridging has been downloaded.

ENGINEER PANEL-BRIDGE COMPANY

Panel-bridge companies will not be programmed in the future force structure except when a sufficient number of MGBs are not available. This company—

- Provides one panel (Bailey) bridge set with sufficient components and cable reinforcement sets to erect bridges of various spans and load classes, to include two 24.4-meter double-truss,

single-story (Class 50 wheeled/Class 60 tracked) bridges without reinforcement sets and one 58.5-meter triple-truss, single-story (Class 50 wheeled/Class 60 tracked) bridge with a reinforcement set, when available. Bridge spans over 100 feet will require additional bridge components.

- Provides technical supervision to assist other engineer units in bridge construction.
- Provides emergency construction of bridges with organic personnel.
- Has 5-ton trucks, with a 150-ton capacity per trip, for earth-moving and general-engineering cargo hauling, when bridging has been downloaded.

ENGINEER ASSAULT FLOAT-BRIDGE COMPANY

Normally assigned to a corps, the number of assault float-bridge companies assigned to a corps is based on the number of heavy and light divisions assigned. This unit—

- Provides personnel and equipment to transport, assemble, disassemble, retrieve, and maintain the assault float bridge at one or multiple bridge sites.
- Provides engineer mission hauling of palletized cargo, in emergencies, by immobilizing bridge loads.
- Has about 213 meters of Class 96 wheeled/75 tank float bridge or 6 Class 96 wheeled/75 tank rafts based on 0 to 3 feet per second velocity.
- Transports up to 560 tons of engineer mission cargo in a single haul over highways and 280 tons of engineer mission cargo in a single haul over unimproved roads and combat trails when the bridge load has been immobilized.

ENGINEER TOPOGRAPHIC COMPANY

Assigned to a corps, this unit builds and maintains a corps's topographic data base using the Army tactical C2 system and various topographic-support systems. Digitized terrain information is extracted from the company data base to produce products that are available to all command levels from corps to brigade. The topographic-support systems interface with the all-sources analysis centers at corps and division to enhance the IPB process and aid in visualizing the battlefield for all corps operations. A topographic company also employs cartographic and reproduction assets that provide combat units with critical terrain data and products such as line of sight, air and ground masking, air and ground mobility corridors, image maps, and intelligence or operations overlays/overprints.

OPERATIONAL-LEVEL ENGINEER UNITS

ENGINEER COMMAND

Assigned to an ASCC, this HQ is the senior engineer in theater that commands and controls the operational-level engineers. The ENCOM—

- Plans and coordinates engineer operational activities for engineer brigades, groups, or other units engaged in construction, topographic, and related engineer missions.
- Plans, coordinates, and supervises general troop and contract construction or rehabilitation support

to the Army and other services and allies within the COMMZ and construction support in a corps's rear area on a task basis.

- Provides the planning, coordination, liaison, and execution of the JCS's Regional Wartime Construction Management System.
- Plans, coordinates, and supervises the construction or rehabilitation of facilities throughout the theater.
- Allocates engineer troops, materiel, and equipment to projects and provides technical assistance to units engaged in construction projects.
- Coordinates topographic and military geographic intelligence support to the theater.
- Coordinates the production of required mapping, military geographic intelligence, and military hydrology services.
- Manages real estate and RPMA throughout the theater under stable operations.
- Manages real estate and RPMA in the COMMZ and technical control of RPMA in the CZ during mobile operations.
- Supervises contract construction and labor, to include US, indigenous, and third-world-country personnel.

ENGINEER BRIGADE, TA

Assigned to an ASCC and normally attached to an ENCOM, this HQ¯

- Provides C2 planning and staff supervision to engineer construction groups or attached engineer units engaged in CS and in constructing and rehabilitating facilities in support of a TO.
- Allocates engineer units and resources in support of engineer operations.
- Supervises engineer units that construct and rehabilitate roads, structures, air-landing facilities, and petroleum storage and distribution facilities.
- Supervises contract construction and labor and indigenous personnel.

ENGINEER GROUP, CONSTRUCTION

Assigned to an engineer brigade, ASCC, or engineer brigade, corps, this engineer group commands and controls assigned or attached engineer combat heavy battalions and separate engineer companies. Normally, the HQ will command and control three to seven engineer battalions. The HQ¯

- Plans, supervises, and coordinates engineer units engaged in survivability, general-engineering, and limited mobility and countermobility operations.
- Plans and supervises units that perform general-engineering tasks such as constructing and repairing combat routes, MSRs, bridges, landing strips, heliports, port facilities, and railroads.

ENGINEER PRIME-POWER BATTALION

Assigned to an ASCC and attached to either an ENCOM or a TA engineer brigade, this battalion consists of one HHC and two line companies. Each line company has a HQ section and six prime-power platoons. This battalion¯

- Generates electrical power and provides advice and technical assistance on all aspects of electrical power and distribution systems in support of military operations.
- Produces electrical power, up to 36 megawatts, in support of C2 sites, hospitals, weapons systems, and logistics-support areas and in relief for tactical generators at fixed sites and critical facilities.
- Repairs and maintains organic power production-and-distribution equipment and distributes power produced with organic systems.
- Operates, maintains, and performs minor repairs to other electrical power-production equipment, to include HN fixed plants.
- Provides electrical-engineering support, such as limited design and analysis capabilities.
- Performs electrical surveys and electrical-related contracting office representatives assistance.
- Manages and coordinates worldwide prime-power requirements.
- Supports RPMA and power-reliability enhancement programs.

HHC, ENGINEER TOPOGRAPHIC BATTALION

Assigned to an ENCOM, this unit—

- Provides C2 for the operating, planning, and supervising topographic units in a TO.
- Provides DS and GS maintenance for topographic, reproduction, air-conditioning, and power-generation equipment to engineer topographic units.
- Provides technical supplies for and performs maintenance on organic equipment, as well as unit maintenance of communications and electronics equipment.

SEPARATE OPERATIONAL-LEVEL COMPANIES

ENGINEER COMPANY, TOPOGRAPHIC BATTALION

Organic to an engineer topographic battalion, this unit—

- Provides topographic-engineering support to operational-level units.
- Provides terrain-intelligence and terrain-analysis products.
- Performs topographic surveys; provides survey information, interpretation, and measurements on the remote-sensed imagery and survey-information system; and maintains deployable point-positioning data bases.
- Complies controlled, semicontrolled, and uncontrolled photomaps and mosaics.
- Revises existing maps and other topographic data.
- Drafts special maps, overprints, overlays, and other topographic products.
- Reproduces, by offset lithography and photocopy, monochrome and multicolor maps, map substitutes, overlays, overprints, and other topographic products.
- Extends horizontal and vertical controls into corps and division areas.
- Stores and distributes special topographic products that it produces.

ENGINEER CONSTRUCTION-SUPPORT COMPANY

Normally assigned or attached to an engineer battalion, combat heavy at the operational level, this unit—

- Provides construction support equipment and personnel for rock crushing, bituminous mixing and paving, and major horizontal construction projects such as highways, storage facilities, and airfields.
- Can produce up to 75 tons per hour (tph) of crushed rock and sand from rock quarries and gravel pits in a two-shift operation, up to 75 tph of washed and sized precrushed rock in a two-shift operation, and up to 150 tph of bituminous mixes and blends for paving projects in a one-shift operation.
- Can supervise contract labor and indigenous personnel and assist in supervising contract construction.

ENGINEER DUMP-TRUCK COMPANY

Normally assigned to an engineer construction support company, this unit—

- Operates dump trucks for moving bulk materials in support of other engineer units.
- Provides a haul capability of up to 600 tons of bulk material, such as gravel, earth fill, and crushed rock, per trip.

ENGINEER PIPELINE-CONSTRUCTION- SUPPORT COMPANY

Normally assigned to an engineer brigade, ASCC, or engineer group, this unit—

- Provides technical personnel and specialized equipment to assist combat heavy battalions or construction units in constructing, rehabilitating, and maintaining pipeline systems.
- Provides advisory personnel to support up to three engineer companies engaged in pipeline construction, pipe coupling, storage-tank erection, and pump-station and dispensing-facility construction.
- Provides specialized tools, equipment, and personnel to operate on a two-shift basis.
- Can transport 21,000 linear feet of 6-inch pipe or 16,200 linear feet of 8-inch pipe over unimproved roads in two lifts.

ENGINEER PORT-CONSTRUCTION COMPANY

Normally assigned to an engineer brigade, an ASCC, or an engineer group, this company—

- Provides specialized engineer support to develop, rehabilitate, and maintain port facilities, to include LOTS operations.
- Constructs, rehabilitates, and maintains offshore facilities, including mooring systems, jetties, breakwaters, and other structures required to provide safe anchorage for ocean-going vessels.
- Constructs, rehabilitates, and maintains piers, wharves, ramps, and related structures required for cargo loading and off loading.
- Constructs facilities for roll-on-roll-off, break bulk, and containerized cargo handling.

- Maintains tanker discharge facilities, including repair or replacement of existing POL jetties and submarine pipelines.
- Installs the off-shore petroleum discharge system, where no naval units are assigned, in support of Army LOTS operations.
- Provides limited dredging and removal of underwater obstructions.
- Provides operators for a two-shift operation of selected specialized equipment.

SEPARATE ENGINEER TEAMS (OPERATIONAL LEVEL)

ENGINEER TEAM, BATTALION HQ

Assigned to an engineer brigade, an ASCC, or an engineer group, the number of battalion HQ teams authorized is based on the number of separate engineer companies and engineer teams. This unit provides C2 for separate engineer companies and engineer teams such as a construction-support company, pipeline company, port-construction company, dump-truck company, and utilities team.

ENGINEER TEAM, FIRE-FIGHTING HQ

Assigned to an engineer brigade or group, the number of teams assigned is based on the number of subordinate engineer fire-fighting teams. The HQ plans for fire-fighting programs and for overall area fire prevention.

ENGINEER TEAM, FIRE-FIGHTING TEAMS

Assigned to an engineer brigade or group, these teams provide fire-fighting support to divisions, area and corps support groups, aviational units, and petroleum pipeline/terminal and petroleum supply companies. Currently, the four types of fire-fighting teams are fire truck, water truck, brush truck, and crash-rescue truck.

ENGINEER TEAM, QUARRY, 75 TPH

Assigned or attached to an engineer battalion, combat heavy, a quarry team—

- Provides rock-crushing operations for use in constructing major horizontal construction projects such as roads, storage facilities, and airfields.
- Provides personnel and equipment for a 24-hour operation of the 75-tph crushing plant and for drilling and blasting operations required to produce raw stone.
- Can haul 30 tons of rock per trip from the quarry to a processing plant.

ENGINEER TEAM, WELL DRILLING

Assigned or attached to an engineer brigade or group, this team can be deployed to support units from division to the operational-level units. The team—

- Provides personnel and equipment for drilling and developing water wells.
- Can drill and cast two complete water-well holes of 5 7/8 inches in diameter.
- Installs casings, screens, and pumps and develops the well to provide water at the wellhead.
- Can sustain two-shift operations.

ENGINEER TEAM, CONTROL-AND-SUPPORT DETACHMENT DIVING

Assigned to an ENCOM, this team—

- Provides C2, liaison, and support functions for engineer diving teams.
- Plans and coordinates engineer diving missions in the theater.
- Provides diving expertise and scuba support to theater commands.
- Augments lightweight diving teams by providing specialized equipment and personnel for deep-sea diving and heavy salvage operations.
- Provides reclassification, supply, and maintenance support to operational-level diving assets.
- Conducts underwater reconnaissance and inspections.
- Performs DS and GS maintenance on life-support systems for lightweight diving teams.
- Supports LOTS operations.
- Depends on a medical element in the TO to provide a physician with diving medicine training to support diving missions.

ENGINEER TEAM, LIGHTWEIGHT DIVING

Assigned to either, a port-construction company, an ASCC, or a corps HQ, this team—

- Performs scuba, lightweight, or deep-sea surface diving to a maximum depth of 190 feet. Diving is done to support light-salvage, harbor-clearance, underwater-pipeline, fixed-bridge, and port-construction repair-and-rehabilitation operations.
- Performs ship husbandry, LOTS, underwater-demolition, cutting, welding, and multiple diving operations.
- Depends on the control-and-support team for specialized supplies, DS/GS maintenance of life-support systems, and augmenting personnel and equipment for deep-sea and heavy salvage operations.
- Performs scuba diving in forward combat areas to perform river and far-shore reconnaissance, clears underwater obstacles as part of combat operations, and supports assault float-bridge operations.

ENGINEER TEAM, REAL ESTATE

Assigned to an ASCC, this team performs functions related to acquiring, using, and disposing of real property for military purposes. A real estate team—

- Manages real estate.
- Investigates and processes real estate claims.
- Conducts utilization inspections.
- Records, documents, and prepares reports on the real estate in the area that the Army uses, occupies, or holds.
- Coordinates with other agencies of friendly HNs to execute joint real estate functions.

ENGINEER TEAM, UTILITIES (4,000)

Assigned to either an ASCC, a TAACOM, an ASG, or a corps HQ, this unit provides limited facilities-engineering support in the areas of carpentry, masonry, electrical, plumbing, and road maintenance and repair.

ENGINEER TEAM, TOPOGRAPHIC PLANNING AND CONTROL

Assigned to a HHC, engineer topographic battalion, this team—

- Performs topographic-operational planning.
- Determines requirements and provides programs for and coordination of topographic-engineering units assigned or attached to the theater.
- Coordinates with the DMA, host/allied nation topographic-support activities, and higher HQ.

US ARMY CORPS OF ENGINEERS' OPERATIONS

The USACE is a functional Army MACOM with worldwide presence. Its mission is to provide engineering services and manage contract construction for the Army and Air Force and the rest of the DOD. USACE also supports other federal agencies in their missions as well. The USACE major subordinate commands (MSCs) or divisions are given geographic responsibilities for executing USACE missions (see Figures A-1 and A-2). USACE execution is supported by a network of engineering laboratories and centers of expertise. USACE is not structured to exercise C2 of troop units in the TO. However, for many practical reasons, USACE does not relinquish command of its subordinate organizations in theater. In general, upon request, the commander, USACE will release operations control of a USACE subordinate organization to the ASCC to be placed under the senior engineer commander in theater. When feasible, USACE is self-sustaining in theater.

USACE DIVISION

As a USACE MSC, the division provides C2 and supports all assigned districts, centers of expertise. It also acquires additional resources from throughout USACE, as required. A variant of the standard USACE division is the operating division which, in addition to having subordinate districts, also operates

Figure A-1. Military construction division/district boundaries

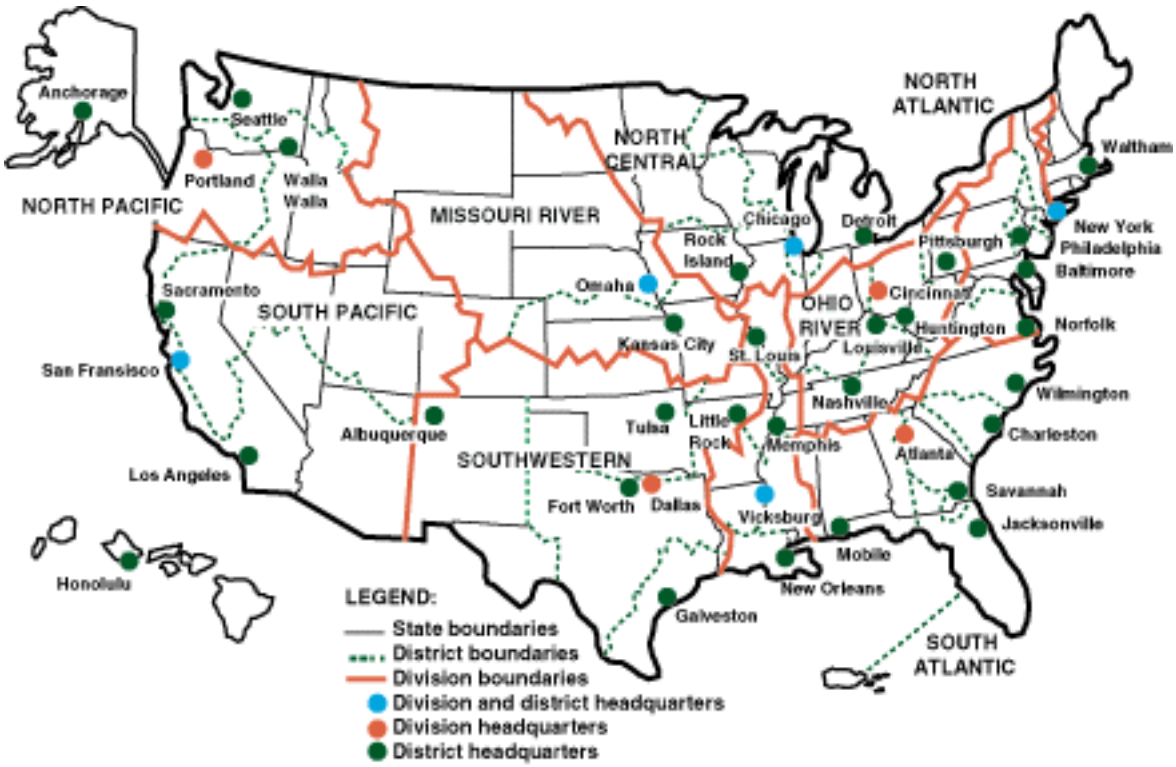


Figure A-2. Civil construction division/district boundaries

as a district within a geographic area. General officers command USACE divisions.

USACE DISTRICT

The district executes the USACE missions. The district is capable of supporting a large number of engineer facilities acquisition (leasing and construction) missions and providing engineer technical assistance in theater directly to customers and to engineer troop units. District (or operating division) HQ that are outside of the AO may deploy a forward element (USACE [Fwd]) to provide in-theater support. The USACE (Fwd) provides the minimum staff element necessary to provide the required operational support. The USACE (Fwd) is electronically linked to its parent HQ for engineering and administrative support and access to technical assistance from all of USACE.

USACE (FWD) ELEMENT

The USACE (Fwd) structure and capability is tailored to meet mission requirements and can be rapidly adjusted to change as the missions change. It is through the USACE (Fwd) that all USACE support (contingency real estate support team [CREST], LOGCAP, and water-detection response team [WDRT]) is provided in theater. The forward element may be commanded by a lieutenant colonel and have a small HQ staff for C2 of one or more area offices and other dispersed teams while also maintaining communications to the parent HQ for purposes of technical and administrative support.

USACE AREA OFFICE

One or more area office may be established to support ongoing USACE engineering, contract management, and/or real estate missions in a given geographical area. Area offices are usually established for missions of some duration in geographically dispersed locations. The area offices may be in DS or GS to a brigade or group HQ, depending on the mission.

APPENDIX B

Engineer Estimate

THE PROCESS

The engineer estimate is an extension of the command-estimate process. It is a logical thought process that the engineer staff officer conducts concurrently with the supported maneuver-force tactical-planning process. The engineer-estimate process—

- Generates early integration of the engineer plan into the combined-arms planning process.
- Drives the coordination between the staff engineer, the supported commander, and other staff officers.
- Drives the development of detailed engineer plans, orders, and annexes. Each step of the engineer-estimate process corresponds to a step of the command-estimate process. Both estimates are continuously refined. Table B-1 shows the relationship between these two estimates. The command-estimate process provides the framework for discussing the corresponding engineer-estimate actions. This appendix details each step of the engineer-estimate process.

RECEIVING THE MISSION

When he receives the mission, the staff engineer quickly focuses on several essential components of the basic order and engineer annex. These are the—

- Enemy situation.
- Mission paragraph.
- Task organization.
- Logistics paragraph.
- Engineer annex.
- Type of operation (offensive or defensive).
- Current intelligence picture.
- Assets available.
- Time available (estimate).

Table B-1. Comparison of command and engineer estimates

Command Estimate	Engineer Estimate
Receive the mission	Receive the mission
Develop facts and assumptions	Conduct an IPB/EBA
Analyze the mission	Analyze the engineer mission
Issue the commander's guidance	Develop a scheme of engineer operations
Develop COAs	War game and refine the engineer plan
Analyze COAs	Recommend a COA
Decide on a COA	Finalize the engineer plan
Issue actions and orders	Issue orders

CONDUCTING THE EBA

The maneuver commander relies on his staff to present him with facts and assumptions on which he can base his mission analysis, restated mission, and COA development. The staff engineer uses the EBA as the framework for developing facts and assumptions. Facts and assumptions pertain to the enemy as well as the friendly situation. Developing and refining them is an ongoing process. The EBA consists of three parts: terrain analysis, enemy mission and M/S capabilities, and friendly mission and M/S capabilities (see Table B-2).

TERRAIN ANALYSIS

Terrain analysis is a major component of the IPB and the first component of the EBA. The objective of the terrain analysis is to determine the impact that the terrain (including weather) will have on mission accomplishment. The staff engineer supports the S2 in this process. Using the OCOKA framework (see Table B-3), they determine what advantages or disadvantages the terrain and anticipated weather offers to the enemy and friendly forces. This process has a direct impact on planning engineer operations. See Table B-4 for examples of how the components of OCOKA could impact engineer support.

ENEMY MISSION AND M/S CAPABILITIES

Threat analysis and threat integration are also major components of the IPB. The enemy's mission and its engineer capabilities are subcomponents of the threat analysis and integration process and the second component in the EBA. The staff engineer supports the S2 during the threat evaluation by focusing on the enemy's mission as it relates to its engineer capabilities. When executing this component, the staff engineer must first understand the enemy's anticipated mission (attack or defend) and consider how, doctrinally, it will employ its engineers.

The staff engineer then develops an estimate of the enemy's engineer capabilities. To do this, he uses the G2/S2's order of battle and the knowledge of enemy engineer organizations and other assets, such as combat-vehicle self-entrenching capabilities, that may impact engineer operations. The staff engineer must also consider hard intelligence pertaining to recent enemy engineer activities.

The staff engineer uses the G2/S2's situation template and the enemy's capabilities estimate to plot the enemy's engineer effort and its location. He coordinates with the G2/S2 and recommends PIRs and the engineer force needed to augment the reconnaissance effort that will confirm or deny the situation template. Enemy engineer activities must be organic to the total combined-arms R&S plan. Table B-5 shows a summary on the enemy's mission and its engineer-capabilities analysis.

In the defense, the staff engineer plots the enemy's—

- Mobility capabilities and location in its formation.
- Use of SCATMINEs.
- Engineers that support the reconnaissance effort.
- HVT (bridging assets, breaching assets, and SCATMINE delivery systems).
- Countermobility and survivability capabilities in a transition to a defense. In the offense, the staff

Table B-2. Engineer battlefield assessment

- Develops facts and assumptions about
  - Enemy engineer weaknesses.
  - Critical friendly engineer capabilities and requirements.
- Supports the S2's IPB mutually.
- Contains three components:
  - Terrain analysis.
  - Enemy mission and engineer capabilities.
  - Friendly mission and engineer capabilities.

Table B-3. OCOKA framework

- Analyze the terrain's impact on the battle using the OCOKA framework:
  - Observation and fields of fire.
  - Cover and concealment.
  - Obstacles.
  - Key terrain.
  - AAs.
- Analyze the advantages/disadvantages the terrain offers the enemy and the friendly force.
- Decide what impact the terrain has on mission accomplishment.

Table B-4. OCOKA impacting engineer support

OCOKA	Examples of Effects on Engineer Support	
Observation and fields of fire	Offense	Requires planning for the obscuration/location of the support force for breaching operations.
	Defense	Reduces obstacle distance from direct fire systems. This might also affect obstacle composition with reduced standoff. Limited fields of fire might limit certain obstacle effects (fix and block).
Cover and concealment	Offense	Requires planning for obscuration/assault positions for breaching operations. Impacts the feasibility for conducting a covert breach.
	Defense	Impacts the required effort for survivability and deception operations.
Obstacles	Offense	Requires the task organization of special engineer mobility assets (AVLB, armored combat earthmover, MB). Plots enemy countermobility effort and obstacles.
	Defense	Ties in reinforcing obstacles to existing obstacles. This might require an increase countermobility effort.
Key terrain	Offense	Targets indirect fire suppression and obscuration for breaching operations.
	Defense	Ties obstacle intent to the retention value of the key terrain.
Avenues of approach	Offense	Requires planning to conduct in stride, deliberate, and covert breaching operations. Requires the task organization of countermobility assets for the transition to a hasty defense and flank protection.
	Defense	Requires the tying of specific obstacle effects to a specific location in an AA. The size of the AA impacts the required countermobility effort.

Table B-5. Enemy mission/engineer capabilities summary

- Anticipate enemy engineer operations and their impact on the battle.
- Consider the enemy's mission and doctrinal employment of engineers in battle.
- Estimate enemy engineer capabilities based on
  - S2's order of battle.
  - Threat engineer organizations.
  - Manpower/equipment capabilities.
  - Recent activities.
- Plot enemy engineer effort based on
  - S2's situational template.
  - Doctrinal engineer employment.

engineer plots the enemy's tactical and protective obstacle effort, use of SCATMINEs, and survivability and fortification efforts.

FRIENDLY MISSION AND M/S CAPABILITIES

The third component of the EBA is estimating the friendly engineer capability and its impact on mission accomplishment. To do this, the staff engineer uses the information he developed in the first step (receive the mission). Since he knows the type of operation, he can quickly place the development of capability estimates in order. He considers the engineer forces task-organized to his supported unit as well as the assets that other members of the combined-arms team have (such as mine plows) to determine the assets that are available. The staff engineer should note the assets under the control of the higher engineer HQ and adjacent engineer units. He may need this information for future reference when he notes a lack of assets during a COA development.

Since the staff engineer has determined what assets are available and has estimated and refined the time available with the G3/S3, he uses standard planning factors or known unit work rates to determine the total engineer capabilities. For example, in the offense, the staff engineer would focus first on the total numbers of breaching equipment (armored vehicle-launched bridges [AVLBs], MICLICs, armored combat earthmovers, CEVs, and engineer platoons) and translate that into breach lanes. In the defense, the staff engineer would determine the number of minefields, hull- or turret-defilade positions, and tank ditches that he could construct with available resources. He would use the results of his capability estimates during the COA development. Table B-6 shows an outline of this analysis.

The staff engineer combines his analysis of the terrain, enemy capabilities, and friendly capabilities to form facts and assumptions about the—

- Likely enemy engineer effort and the most probable enemy COA.
- Potential enemy vulnerabilities.
- Critical friendly requirements.
- Impact these factors have on the mission. Developing facts and assumptions is a detailed and sometimes lengthy process. The staff engineer must stay focused on the information the maneuver commander and his battle staff require to make decisions. The EBA is a continuous process that is refined as the situation becomes clearer. Each time new information is collected or the conditions change, the staff engineer must evaluate its impact on the mission and refine the facts and assumptions as necessary.

ANALYZING THE MISSION

The staff engineer participates in mission analysis by identifying engineer tasks that are mission-critical and have an impact on the overall mission. He identifies engineer tasks from the higher unit's entire OPORD, not just the engineer annex. He must examine the entire OPORD to fully understand the total scheme of maneuver, the commander's intent, and the instructions from the higher unit's staff engineer. The staff engineer should concentrate on the following portions of the OPORD as he receives and identifies the engineer mission:

- Paragraph 2, Mission.

Table B-6. Friendly mission/engineer capabilities summary

- Evaluate friendly engineer capability and its impact on accomplishing the mission.
- Consider the friendly mission.
- Estimate the engineer assets available based on the task organization of
  - Maneuver forces.
  - Engineer forces.
  - Higher engineer HQ.
  - Recent activities.
  - Adjacent engineer units.
- Consider the availability of critical resources.
- Estimate the total engineer capability based on engineer planning factors.

- Paragraphs 1b and 3, Commander's Intent (two levels up).
- Paragraph 3, Scheme of Maneuver.
- Paragraph 3, Scheme of Engineer Operations.
- Paragraph 3, Subunit Instructions.
- Paragraph 3, Coordinating Instructions.
- Paragraph 4, Service Support.
- Paragraph 5, Command and Signal.
- Engineer Annex. Mission analysis has several components; the staff engineer should focus on engineer capabilities in each component.

SPECIFIED TASKS

These tasks are derived directly from the WO, OPORD, or commander's intent. Examples are obstacle zones, obstacle belts with intents, the required number of breach lanes, and the type of breach that the higher commander designates.

IMPLIED TASKS

The staff engineer develops implied tasks by analyzing the mission in conjunction with the facts and assumptions he developed earlier. Two examples of implied tasks are—

- Coordinating obstacle handover during a relief-in-place mission.
- Identifying and planning a river-crossing operation. This task occurs to support an attack of seizing an objective if a river crossing is necessary to accomplish the mission but is not specified in the higher OPORD.

ASSETS AVAILABLE

The staff engineer identifies available engineer assets in the EBA. However, he should examine the total force structure of the combined-arms team to help him as he participates in the COA development. For example, determining the amount of available firepower may help him determine whether the force should conduct an in-stride or a deliberate breach or which float bridge a division has available to support a river-crossing operation.

LIMITATIONS (CONSTRAINTS AND RESTRICTIONS)

Constraints are those specified tasks that limit freedom of action. For example, designated reserve obstacles, obstacle zones (with intents), and obstacle restricted areas (ORAs) are constraints that the staff engineer must consider in his mission analysis. Restrictions are limitations placed on the commander that prohibit the command from doing something. Therefore, they impact greatly on the COA development. For example, obstacle zones and ORAs are restrictions because they limit the area in which tactical obstacles can be placed.

RISK

A commander might specify which risk he will accept to accomplish the mission. For example, he may employ the priority obstacle effort in a defense on the most likely enemy AA, but he may plan to use situational obstacles on the most dangerous AA as an economy-of-force measure. The staff engineer must understand how a risk that involves an engineer capability will specifically impact on combined-arms operations and advise the commander accordingly.

TIME ANALYSIS

The staff engineer must ensure that engineer operations are included in the combined-arms time analysis. A time analysis has several steps. First, the staff engineer determines the actual total time available. Second, he establishes a fact or assumption of the time available while preparing the friendly capabilities portion of the EBA. Third, he refines his time analysis. A good tool to use in this process is a basic time-line sketch. With the sketch, the staff engineer can accurately refine the estimate of the amount of time actually available and adjust the friendly engineer capability accordingly. Some items in the time-line sketch are the—

- Supported unit's OPORD.
- Engineer unit's OPORD.
- Movement times.
- Line-of-departure or prepare-to-defend times.
- Rehearsals.
- Hours of darkness or limited visibility.

ESSENTIAL TASKS

Essential tasks are the specified and implied tasks that are critical to mission success. The staff engineer develops his plans, staff coordination, and allocation of resources on the essential tasks. He does consider the other specified and implied tasks, but his planning centers on the essential tasks.

RESTATED MISSION

The restated mission follows the same format as any mission statement. The who, what, where, and why of the restated mission are based on the mission analysis and then become the mission statement in paragraph 2 in the OPORD.

DEVELOPING A SCHEME OF ENGINEER OPERATIONS

The staff engineer must receive planning guidance to tailor the schemes of engineer operations that he will develop during COA development. How much guidance he needs depends on his and the maneuver commander's experience, their relationship, the time available, and the SOPs. The staff engineer might require guidance in—

- Situational obstacle planning.
- The use of digging assets (survivability versus countermobility).
- The use of maneuver forces in the obstacle effort.
- Risk acceptance of M/S tasks.
- Interpreting the higher commander's intent pertaining to M/S. The next step of the command/engineer estimate is developing the maneuver COAs. COA development centers on employing maneuver forces. The staff engineer assists in the process by considering what impact the engineer operations will have on the maneuver. He develops a scheme of engineer operations for each maneuver COA. He develops a concept, not the complete plans, and he does this by using the same steps as the maneuver COA but without the detailed force allocation. If time permits, he can work on the details for each plan. Table B-7 shows the following process:

ANALYZING THE RELATIVE COMBAT POWER

The staff engineer compares the anticipated enemy engineer capability with the friendly engineer's capability needed to defeat it. For example, in the offense, the staff engineer considers the enemy's doctrinal norms, hard intelligence, recent activities, and the time the enemy has to prepare. He then determines if the friendly engineer's capability is sufficient to overcome the enemy's capability. In the defense, the staff engineer looks at an enemy's capability and where and when he expects that capability to be employed. He then determines what will defeat the enemy and what assets are available to ensure success.

IDENTIFYING THE ENGINEER MISSIONS AND ALLOCATING FORCES

Based on the maneuver COA, situation analysis, mission analysis, and commander's intent, the staff engineer assesses the engineer's requirements. This is the most important step in developing a scheme of engineer operations.

DEVELOPING A SCHEME OF ENGINEER OPERATIONS

The scheme of engineer operations focuses on how the engineer efforts integrate into and support the maneuver COA. Like the maneuver COA, the scheme of engineer operations is generic, without a specific engineer force allocation or unit designation. It must address all phases of the operation, especially where engineer priorities must change to support the maneuver.

BALANCING AVAILABLE ASSETS AGAINST SUPPORT REQUIREMENTS

The staff engineer reviews his scheme of engineer operations in light of the assets he has available (using his EBA product). He uses hasty estimate tools, such as belt-planning factors, blade-hour estimates, and breach-lane requirements, to assess quickly whether adequate assets are available to support the plan. He notes all shortfalls and refines the scheme of engineer operations, if necessary. He refines the plan by shifting assets to the main effort, shifting priorities with the phases of the operation, recommending that

Table B-7. Scheme of engineer operations process

1. Analyze relative combat power.
2. Identify engineer missions and allocate forces/assets.
3. Develop a scheme of engineer operations.
4. Balance requirements with assets available.
5. Integrate into the maneuver COA.

the commander accept risk, or requesting additional assets.

INTEGRATING INTO THE MANEUVER COA

The staff engineer prepares a statement describing the scheme of engineer operations. He addresses how engineer efforts support the maneuver COA and integrates the necessary graphics (breach-control measures and obstacle graphics and intents) to show this tentative engineer plan.

WAR GAMING AND REFINING THE ENGINEER PLAN

War gaming is a systematic way to see the enemy's actions and reactions to each friendly COA. Its techniques are used to analyze the COA. Staff analysts identify the best COA and recommend it to the commander. (Table B-8 shows three techniques for war gaming.) The staff engineer participates in war gaming to—

- Ensure that the scheme of engineer operations supports the maneuver plan and is integrated with the other staff elements.
- Identify weaknesses in his plan and make adjustments, if necessary.
- Ensure that the G2/S2 integrates enemy engineer assets and actions as he plays the enemy force. After analysis, each COA is war-gamed and the results compared. The goal of comparing COAs is to analyze their advantages and disadvantages relative to the other plans, using specific evaluation criteria. Either the staff or the commander, during his planning guidance, develops the evaluation criteria. The staff engineer compares COAs in terms of which scheme of engineer operations best supports mission accomplishment. His comparison is only part of the total comparison by the staff.

RECOMMENDING A COA

The objective of the comparison is to make a unified recommendation to the commander on which COA is best. The staff engineer may have to consider a COA that he can least support if, from the other staff perspectives, it is the best selection. He must be prepared to inform the maneuver commander—

- Where he must accept risk or what additional assets he will need to avoid that risk.
- Where those assets may be obtained.
- What influence the maneuver may have to exert to get them. Based on the staff's recommendations, the commander decides which COA to adopt for final planning. He may select a specific COA, modify a COA, or combine parts of COAs. Regardless, the commander decides and issues additional guidance for developing the plan to the staff. This guidance concentrates on synchronizing the fight, focusing on bringing the combat multipliers together.

Table B-9. Three war-gaming techniques

Avenue In Depth

This technique concentrates on one AA from start to finish. It is equally applicable to offensive and defensive operations. It allows the engineer to war game the analyzed impact of enemy obstacles on the plan of attack and the effects of sequential obstacle belts or groups for the defensive plan.

Belt

The belt technique divides the battlefield into areas that run the width of the sector, war gaming across the front and multiple avenues at once. This is the preferred technique. It allows the engineer to war game the mutual support between obstacle belts and groups. It is the best method for analyzing mutual support and adjacent engineer effort.

Box

This technique focuses solely on critical enemy or friendly events in a designated area (box). The advantage of this method is that it is not time consuming. It allows the engineer to focus on a particular breach site or EA.

FINALIZING THE ENGINEER PLAN AND ISSUING THE ORDER

The staff engineer focuses his planning efforts on the scheme of engineer operations for the selected maneuver COA. He determines the C2 necessary to accomplish the engineer missions (see Chapter 2 for additional information). The scheme of engineer operations is fine-tuned based on the war-gaming process, commander's guidance, and situation updates. As the staff engineer fills in the details of his plan, he refers to his initial mission analysis to ensure that he accounts for all missions. He ensures that he assigns all engineer tasks to maneuver and engineer units as part of the subunit instructions. He coordinates with other staff members to ensure total integration and mutual support.

The staff engineer uses the basic OPORD (scheme of engineer operations, subunit instructions, coordinating instructions paragraphs) and the engineer annex (see Appendix C) to supply his input. As part of the combined-arms staff, he participates in the OPORD brief to the assembled command group. He briefs the command group on the scheme of engineer operations only once.

APPENDIX C

Orders and Annexes

SUPPORTED-UNIT'S ORDERS AND ENGINEER ANNEX

Orders and annexes are critical components of engineer C2. The engineer commander exercises functional control over the supported-unit engineer operations by including critical instructions in the supported-unit basic order and the engineer annex. He issues a unit order to control the forces he commands. Therefore, he must use a combination of supported-unit and engineer-unit orders to convey the engineer plan.

This appendix addresses the supported-unit OPORD and the engineer annex. Areas covered are the base format of the supported-unit OPORD, highlighting areas where the engineer commander may have direct input, the format and content of the engineer annex, and sample overlays. This appendix also addresses engineer-unit orders. Areas covered are the format and content for the engineer-unit WO and OPORD, including possible annexes, overlays, and FRAGOs.

SUPPORTED-UNIT'S OPORD

Figures C-1a, C-1b, and C1c are a sample format of the supported-unit's OPORD. Paragraphs in which the engineer commander may provide engineer input are bolded.

ENGINEER ANNEX

The engineer annex contains information that is not included in the supported-unit basic order but which is critical to the supported-unit engineer plan or required for subordinate engineer planning. It does not include instructions or orders directly to engineer units. All instructions or tasks are addressed to units supported by engineer units, not supporting engineer units. More importantly, the engineer annex covers essential aspects of the entire engineer plan, not just parts that pertain to engineer units.

The engineer annex is not a replacement for a unit order. For example, it does not give subunit orders and service-support instructions to engineer units remaining under the engineer's command. Those orders and instructions are contained in the engineer-unit order. The engineer annex should be clear, complete, brief,

(Classification)

Copy of copies
(Issuing HQ)
(Place (coordinates) country)
(Date-time group, month, year)
(Message reference number)

OPERATION ORDER (number) (code name, if used)
Reference(s): Map(s) and other references required.
Time zone used throughout the order:

Task Organization:

- **Show engineer task organization of engineer units supporting other units to include the command or support relationship, as accurately as possible.**
- **List units remaining under engineer control.**

1. SITUATION.

   a. **Enemy Forces. Include the enemy's recent engineer activities or capabilities that are critical to supported-unit commanders or essential to understanding the engineer plan.**

   b. Friendly Forces.

   c. **Attachments and Detachments.**

      - **State effective time for engineer task organization, if different than other units.**
      - **Clarify or highlight changes in engineer task organization that occur during a phase of the operation; for example, releasing division's control of the bridge units back to corps.**

2. MISSION.

3. EXECUTION.

   Intent:

   a. Concept of the Operation.

      (1) Maneuver.

      (2) Fires.

      (3) Counterair operations.

      (4) Intelligence.

         - **Include focus of engineer intelligence-collection efforts that impact on the maneuver plan.**

Figure C-1a. Sample of supported-unit OPORD

- Provide subordinate units with engineer information requirements that are command PIR, as coordinated with the G2/S2 and supported-unit commander.

(5) Electronic warfare.

(6) Engineer.

- Describe the concept of engineer operations to support the supported-unit plan.
- Establish main effort of engineer effort by mission and unit for each phase of the operation.
- Focus primarily on engineer support to close and rear operations.
- Discuss supported-unit-level engineer missions only as they impact on supported-unit subordinate commanders.

(7) (Others as needed)

b. Tasks to Maneuver Units.

- List mission-essential engineer tasks that a specific supported-unit subordinate element will accomplish.
- List mission-essential engineer tasks that engineers task-organized to supported-unit subordinate elements must accomplish.

c. Tasks to Combat-Support Units. Include the supported-unit-level engineer tasks assigned to the supporting engineer unit, if necessary. List these tasks only to inform supported-unit subordinate commanders of engineer tasks under supported-unit control using supported-unit-level forces.

d. Coordinating Instructions.

- List critical engineer instructions common to two or more supported-unit subordinate units.
- Do not include SOP information unless needed for emphasis.
- List times or events in which obstacle-control measures become effective if different from the effective time of the order, if necessary.

4. SERVICE SUPPORT.

a. General Concept of Logistic Support.

- Define concept for push of Class IV and V (mines).
- Define concept for logistics support of organic and supporting engineers task-organized to the supported unit, if not listed in service-support annex.

b. Materiel and Services.

Figure C-1b. Sample of supported-unit OPORD (continued)

(1) **Supply.**

- **List supported-unit subordinate-unit allocations of Class IV or engineer Class V supplies if not contained in the engineer annex.**
- **List tentative locations for transfer of Class IV and V (mines) to supported-unit subordinate units.**

(2) Transportation.

(3) Services.

c. Medical Evacuation and Hospitalization.

d. Personnel.

e. Civil-Military Cooperation.

f. Miscellaneous.

5. COMMAND AND SIGNAL.

a. Command.

b. Signal.

Acknowledge:

Commander's signature (optional)
Commander's last name
Rank

Official:
(Authentication)
Annexes:
Distribution:

Figure C-1c. Sample of supported-unit OPORD (continued)

and timely and avoid qualified directives. It should include—

- Critical information derived from the EBA process.
- All critical information and tasks not covered elsewhere in the order.
- Items not covered in SOPs.
- Information and tasks directed to major subordinate elements of the supported unit, not supporting engineer units.
- Information and instructions that have been fully coordinated with other parts of the OPORD, supported-unit commander, and staff. The engineer annex includes any combination of written instructions, matrices, or overlays needed to convey the necessary details of the engineer plan. The annex in Figures C-2a, C-2b, C-2c, and C-2d provides a standard format for both offensive and defensive operations. This format standardizes the organization of information included as written instructions. The actual content of the annex depends on the type of operation and engineer plan. A standardized annex format makes it easier for the engineer staff officer to remember what should be included and for subordinate staff officers to find required information.

  The engineer annex may include matrices and overlays, as necessary, to convey the plan. Matrices may be used as part of the body of the annex or as separate appendixes. They are used to convey or summarize information not needing explanation, such as logistic allocations, obstacle priorities and restrictions, or task summary (execution matrix). Overlays are used to give information or instructions and expedite integration into the overall combined-arms plan. Information included on overlays may include, but is not limited to-
- All existing and proposed friendly obstacles and control measures (obstacles, restrictions, and lanes; directed or tactical reserve obstacles; and situational obstacles, including associated NAI/TAI).
- Known and plotted enemy obstacles (must also be on the situation template).
- Logistic locations and routes, as they apply to engineer operations.
- NBC contaminated areas.
- SCATMINE restrictions.
- River-crossing locations and restrictions. Figures C-3, C-4, and C-5 show sample matrices and overlays.

ENGINEER-UNIT ORDERS

The engineer commander uses a unit order to exercise unit control over engineer units remaining under his command. At the outset of an operation, he uses his order to effect the necessary task organization of engineers, assign initial missions, and establish sustainment integration supporting units. Once the task organization is effective, and during combat operations, the engineer commander directs subsequent unit orders only to those engineers under his command. Orders, missions, and instructions to engineers supporting other units in command relationships are included as tasks to the units in the supported-unit order. The engineer-unit WO is the exception.

The engineer commander issues WOs to engineers to facilitate parallel planning within engineer units and supported-unit engineer staffs. WOs to engineers supporting another unit are for planning only and

ANNEX (ENGINEER) TO OPORD

Task Organization:

- List engineer units only and task-organize them to the supported-unit subordinate elements or under the engineer unit.
- Include summary of low-density equipment, if necessary, to clarify unit task organization.
- Address command and support relationships, as appropriate.
- Identify changes in engineer task organization that occur during the operation.

1. SITUATION.

a. Enemy Forces.

(1) Terrain. List critical aspects of the terrain that impact on engineer operations.

(2) Weather. List critical aspects of the weather that impact on engineer operations.

(3) Enemy engineer's capability/activity.

- Highlight known and templated locations and activities of enemy engineer units.
- List the enemy's significant maneuver and engineer capabilities that impact on engineer operations.
- Detail expected employment of engineers based on most probable enemy COA.

b. Friendly Forces.

- Define designation, location, and activities of higher and adjacent engineers impacting on the supported unit or requiring coordination.
- List nonengineer units capable of assisting in engineer operations, such as emplacing SCATMINEs.

c. Attachments and Detachments.

- List units attached or detached, if necessary, to clarify task organization.
- Highlight changes in engineer task organization that occur during an operation, with effective times or events.

2. MISSION. Same as supported-unit mission statement.

3. EXECUTION.

a. Scheme of Engineer Operations.

- Describe the concept of engineer operations to support the maneuver plan. Must tie critical engineer tasks or engineer main effort to the supported-unit defeat mechanism.

Figure C-2a. Sample engineer annex

- Establish main effort of the engineer effort by mission and unit for each phase of the operation.
- Focus primarily on engineer support to close operations.
- Discuss supported-unit-level engineer missions only as they impact on supported-unit commanders.

(1) Obstacles.

- Supplement above narrative, focusing specifically on the details of the countermobility effort.
- Identify obstacle-control measures used to enhance the supported-unit deep, close, and rear operations. Assign obstacle responsibilities, priorities, and restrictions. Restrictions may preclude the use of certain type mines/obstacles or the use of obstacles on specific routes through obstacles.
- Identify, assign, and place priorities on responsibilities for supported-unit directed and reserve targets. Provide execution criteria for reserve targets.

(2) Situational obstacles.

- Explain concept for employing situational obstacles, focusing on how to use them to support the maneuver plan.
- Identify location, intent, and execution criteria of supported-unit-level targets planned and executed by the supported unit.
- Assign responsibilities for executing supported-unit situational obstacles targeted and resourced by the supported unit. Discussion must include the details on NAIs, TAIs, decision points, and execution criteria.
- Assign intent and allocate resources to brigades regarding supported-unit resourced and subordinate-unit planned and executed. May also state an execution criteria.
- State clearly, for each type, the HQ that maintains the authority to use SCATMINEs and any restrictions on duration (by obstacle-control measure).

b. Subunit Instructions. (All tasks are listed as subordinate-unit missions.)

- List engineer tasks which are not in the basic OPORD that a specific subordinate unit will accomplish.
- List engineer tasks which are only necessary to ensure unity of effort that engineers supporting the supported-unit subordinate elements will accomplish.
- May list the supported-unit-level engineer tasks assigned to the supporting engineer unit. List them only to inform supported-unit subordinate commanders of engineer tasks that are under the supported-unit control using supported-unit-level forces.

c. Coordinating Instructions.

- List critical engineer instructions that are common to two or more supported-unit subordinate elements that are not covered in the basic OPORD.

Figure C-2b. Sample engineer annex

- Do not include SOP information, unless it is needed for emphasis.
- Include times or events in which obstacle-control measures become effective if they are different from the effective time of the order.
- List supported-unit PIR that subordinate engineer staff officers must consider or that supported-unit engineer requires.
- List mission reports that the supported-unit engineer requires, if they are not covered in *Signal* paragraph or unit SOP.
- Include explanation of IEWL's, if they are used.

4. SERVICE SUPPORT.

a. Command-Regulated Classes of Supply. Highlight brigade allocations of command-regulated supply classes that impact on engineer operations control supply rate (CSR). May summarize in a matrix or table.

b. Class IV and V (Obstacle) Supply Distribution Plan.

- State the supply method (supply point or unit distribution) to be used for Class IV and V (obstacle) for each supported-unit subordinate element.
- List tentative locations for Class IV and V supply points or locations for linkup of corps's push packages direct to units.
- List allocation of Class IV/V (obstacle) by supported-unit subordinate element by obstacle-control measure or combination. May summarize in a matrix or table.

c. Transportation.

- List allocation and priority of support for haul and airlift assets dedicated to supported-unit subordinate elements for Class IV and V (obstacle) haul.
- List requirements for supported-unit subordinate elements to supplement corps's transportation of mission loads: for example, brigade is responsible for haul forward of phase line (PL) . each brigade will provide heavy expanded-mobility tactical vehicles (HEMMTs) to haul mission.

d. Health-Service Support. Address special arrangements made for corps engineer units operating in forward areas to accomplish supported-unit-level missions.

e. HN Coordination.

- List type and location of HN engineer facilities, assets, or support.
- List procedures for requesting and acquiring HN engineer support.
- Highlight any limitation or restrictions on HNS: for example, HN personnel not authorized forward of PL .

Figure C-2c. Sample engineer annex

5. COMMAND AND SIGNAL.

a. Command.

- List location of key engineer leaders.
- List location and planned movements of engineer CPs during the operation.
- Designate a logical chain of command.
- Designate an engineer HQ that controls the engineer effort within JFWIs on an area basis.

b. Signal.

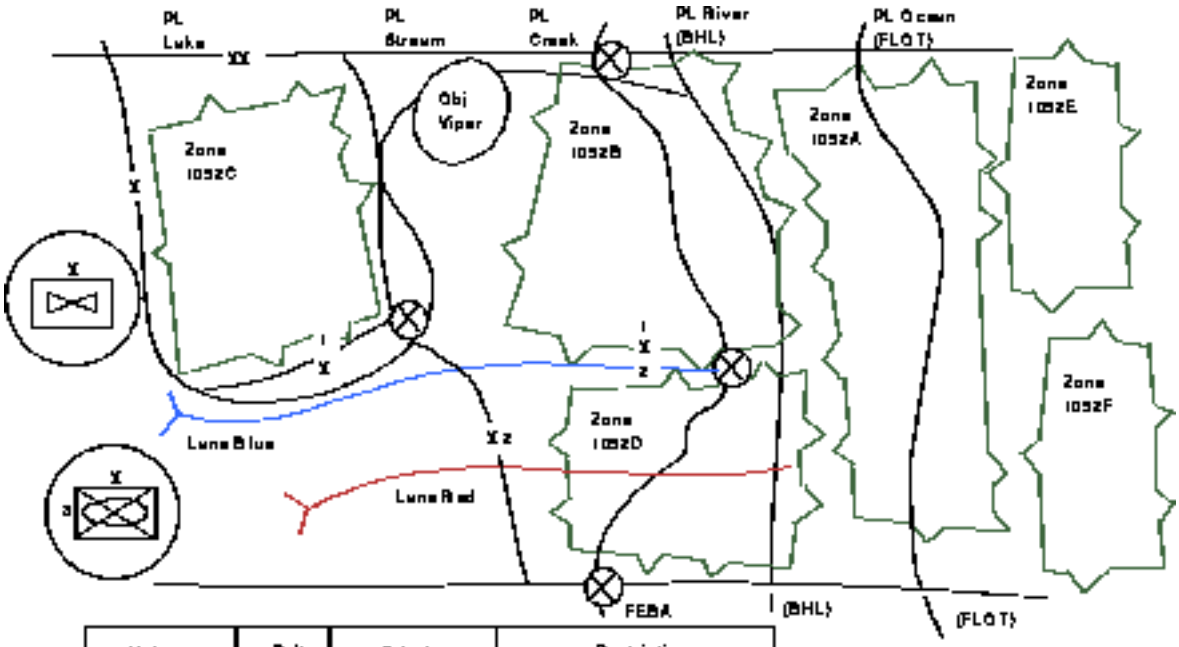
- Ensure that engineer CPs monitor the Nationwide Emergency Telecommunications System (NETS) for reports, if different than the SOP.
- May designate critical engineer reporting requirements of subordinates, if not covered in coordinating instructions or SOP.

Acknowledge:

Commander's signature (optional)
Commander's last name
Rank

Official:
/s/
Name:
Position:
Appendixes:

Figure C-2d. Sample engineer annex



Unit	Bdt	Priority	Restrictions
1st bde	1052B	1 (Ot0) 3rd bde)	Restricted along Lune Blue
1st bde	1052C	4	
2nd bde	1052D	2	Restricted along Lune Red
AV bde	1052E	5	Restricted no long duration
AV bde	1052F	Ot0	SCATMINEs
Cav sqdn	1052A	3	

NOTE
- Obstacles not eligible for breaching HCs

Figure C-3. Obstacle overlay

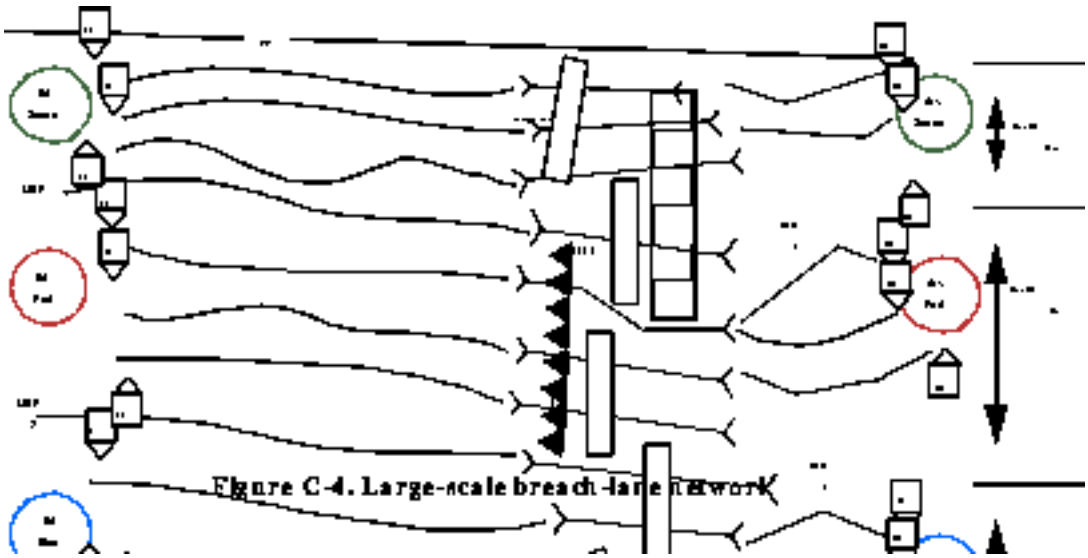


Figure C-4. Large-scale breach-lane network

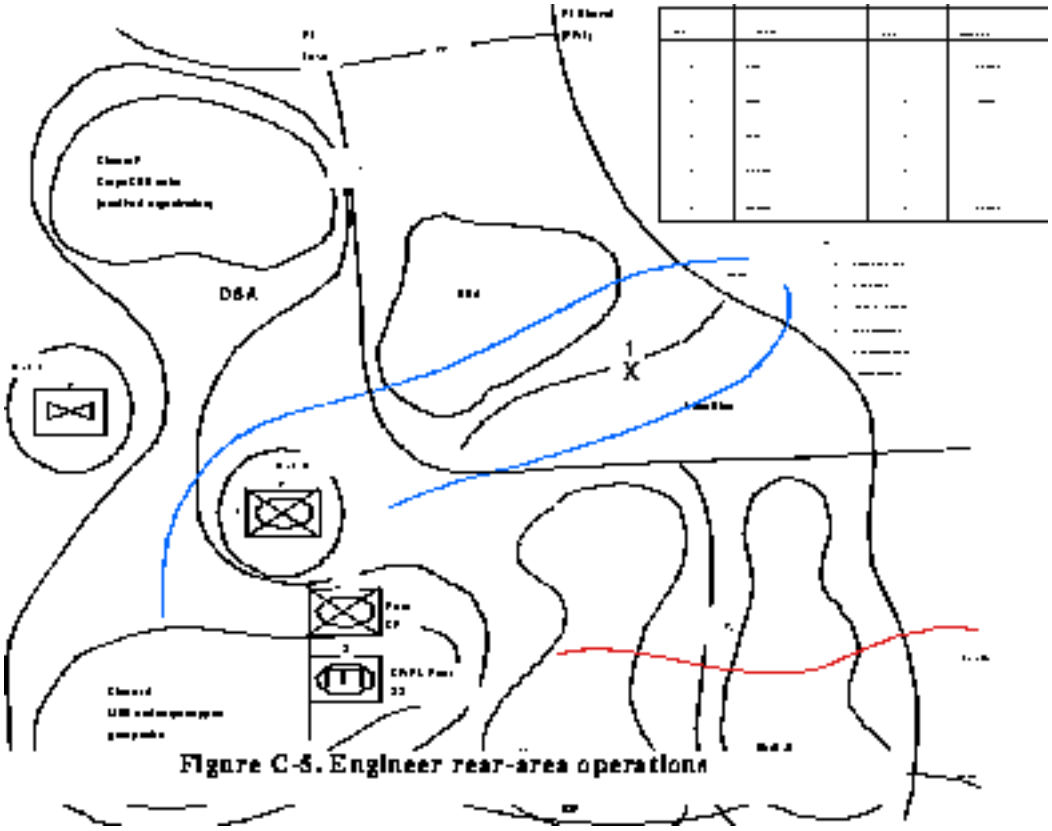


Figure C-5. Engineer rear-area operations

are not executive.

ENGINEER-UNIT WO

A WO helps engineer staff officers and engineer units initiate planning and preparations for an upcoming operation. It is critical to foster parallel planning at the engineer-unit and supported-unit levels. There is no prescribed format for the WO. It may be either written or oral but should include the following information:

Heading

WOs must always begin with the words "Warning Order" so the recipients understand that they are to use the information as a basis for planning and that orders will follow. The addressees should also be listed in the heading. The engineer-unit WO should address all supporting engineer units.

Situation

This section includes a brief description of friendly and enemy situations and critical events. It may also include probable missions for the supported unit and specified or implied tasks. It may assign tentative tasks for planning only to engineer units.

Attachments and Detachments

This section gives tentative and known changes to the task organization. However, engineers supporting another unit must realize that these changes are for planning purposes and will not be effective until they receive an order from the supported-unit higher HQ.

Earliest Time of Move

This section states the earliest possible time that units must be ready to move. For units under the engineer commander's command, actual movement times may be given, if known. The earliest time of move is critical to synchronizing sustainment operations to support future missions.

Nature and Time of the Operation

This section provides information about the supported-unit plan to foster parallel planning and preparations and to set priorities. Depending on the maturity of the planning process, information may include a concept of engineer operations or tentative scheme of engineer operations. Orders for preliminary action may also be included: assigning engineer tasks such as tactical and technical reconnaissance, establishing Class IV and V supply points, establishing bridge parks, and moving to linkup points. These orders are normally qualified as be-prepared or on-order tasks, depending on how the plan is established. Orders to engineers supporting other units are always on order with execution instructions coming through supported-unit headquarters-generated orders.

Time and Place of Orders Group

Information in this section informs units under the engineer commander's command when and where to

receive the entire order and who will attend. Engineer-unit SOPs should identify the composition of the orders group.

Administrative and Logistical Information

This section includes instructions and warning information on changes in unit logistical operations and required coordination/link up with the supported-unit sustainment systems as required by future operations. This information may also direct movement to assembly areas and provide instructions for sustainment after movement.

Acknowledgment

An acknowledgment of receipt is always required to make sure all addressees receive the WO.

ENGINEER-UNIT OPORD

The engineer commander issues OPORDs to all units under his command. Initially, the engineer commander's OPORD may include any engineer unit operating in the supported-unit area, as necessary, to effect the task organization, assign missions, and establish sustainment responsibility at the outset of an operation. Once the task organization is effected, all instructions and missions to engineers supporting other units are conveyed in supported-unit orders and are addressed to the subordinate supported-unit commanders. The following is an outline of the content of engineer-unit OPORDs using the standard five-paragraph field order (Figures C-6a, C-6b, C-6c, C-6d, C-6e, and C-6f). When the order is an OPLAN instead of an OPORD, assumptions on which the plan is based are included at the end of the Situation paragraph.

ENGINEER-UNIT FRAGO

The engineer commander will frequently need to modify his OPORD by using FRAGOs to make changes in engineer operations that allow the supported unit to take advantage of tactical and operational opportunities. He issues FRAGOs only to engineer units under his command. (Supported units will issue their own FRAGOs to convey changes in instructions to engineers supporting other units in command relationships.) A FRAGO does not have a specified format, but an abbreviated OPORD format is usually used. A FRAGO should maximize the use of the current OPORD and specify only information and instructions that have changed.

Rarely will the engineer commander issue a FRAGO to his subordinate commanders face-to-face. He will normally issue it over the radio or telephone. He may use a staff member to issue the FRAGO in person to subordinate engineer commanders. This ensures the engineer commander that the commanders understand the FRAGO, and it allows the commander to include graphics. The engineer commander should include the following items in a FRAGO:

Changes to Task Organization

Include any changes to unit task organizations made necessary by modifying the order.

Situation

(Classification)

Copy of copies
(Issuing engineer HQ)
(Place (coordinates) country)
(Date-time group, month, year)
(Message reference number)

OPERATION ORDER (number) (code name, if used).
Reference(s): Map(s) and other references required.
Time zone used throughout the order:

Task Organization:

- Include all engineer HQ of units under supported-unit control.
- Include all engineer HQ of organic units.
- List units task-organized to a HQ other than their parent unit.
- List special equipment if not clear in unit task organization, if needed.
- Address command-support relationships, as necessary.

1. SITUATION.

a. Enemy Forces.

(1) Terrain and weather.

- List key aspects of the terrain that affect engineer operations.
- Identify key and decisive terrain in the supported-unit area that relates to engineer operations.
- Include expected weather conditions and their impact on engineer operations.
- Include light data and its impact on engineer missions.

(2) Enemy situation.

- Include a macro picture of enemy forces facing the supported unit.
- List current disposition of enemy forces, to include location of major enemy units (known and templated), strength, designation (if known), composition, and current activities.
- List enemy engineer activities and capabilities.
- List most probable enemy COA.
- Highlight enemy activities, capabilities, and COAs that affect supported-unit-level engineer operations.

Figure C-6a. Sample engineer-unit OPORD

b. Friendly Forces.

(1) Higher.

- State supported unit's and commander's intents (two levels up); paraphrase commander's intent as it applies to engineer operations.
- Describe, briefly, the higher unit's plans, highlighting those aspects that give purpose to engineer missions.
- Describe the higher-unit (two levels up) engineer plans and priorities as they apply to the supported-unit (one level up) engineer operations.

(2) Adjacent. Highlight missions of adjacent supported units and engineer units that impact on the supported-unit engineer missions.

c. Attachments and Detachments.

- List attachments and detachments of organic and supporting engineers to the supported unit, as necessary, to clarify the task organization.
- Highlight any attachments and detachments that occur during the operation, to include the time and the event that trigger change.

2. MISSION.

- Include Who the engineer unit is.
- Include What, When, Where, and Why of the supported-unit mission. (Include any essential supported-unit-level engineer missions as part of the What.)

3. EXECUTION.

Intent:

- State the force engineer's vision of the engineer operation and how it supports the supported-unit plan.
- Describe the purpose of engineer operations.
- Describe the end state of supported-unit engineer operations and its link to the end state of the supported-unit operation.
- Do not describe the scheme of engineer operations or subunit tasks.
- Link engineer's intent to the supported-unit defeat mechanism.

a. Scheme of Engineer Operations.

- Write a clear, concise narrative of the engineer's plan from beginning to successful end. Use phases of supported-unit plan, organization of the defense, or battlefield framework to organize the narrative.

Figure C-6b. Sample engineer-unit OPORD

- Ensure that the narrative's focus is on mission-essential engineer tasks and force engineer's main effort. The narrative is not a summary of all engineer tasks.
- Identify, clearly, the engineer's main effort and how it shifts during the operation to support the supported-unit plan.

(1) Obstacles.

- Supplement the above narrative. Focus specifically on the details of the countermobility effort. Based on the nature of supported-unit-level engineer missions, instructions may concentrate only on obstacles in the rear area.
- Identify obstacle-control measures used to support the supported-unit deep, close, and rear operations. Assign obstacle responsibilities, priorities, and restrictions to supported-unit-level countermobility efforts and engineer units.
- Identify and assign responsibilities for supported-unit directed and reserve targets that the supported-unit-controlled engineer units prepare.

(2) Situational obstacles.

- State the concept for employing situational obstacles, focusing on how they will be used to compliment or augment conventional tactical-obstacle efforts. Include details on NAIs, TAIs, decision points, and execution criteria if the SCATMINE target is supported-unit-directed and executed by supported-unit-controlled engineer units.
- State, clearly, the HQ that maintains the authority to use SCATMINEs and any restrictions on duration (by obstacle-control measure).

b. Tasks to Engineer Units.

- List all tasks assigned to engineer units remaining under the control of the force engineer, clearly and concisely.
- List each engineer unit that remains under the force-engineer's control.
- Assign tasks by unit, and try to list them in the order that they will be executed during the operation.
- Distinguish *be-prepared* and *on-order* tasks from normal tasks.
- Do not include tasks and instructions that are common to two or more units.
- Include all supported-unit-level engineer missions identified during the engineer-estimate process.

c. Coordinating Instructions.

- Include tasks and instructions that are common to two or more units subordinate to the force engineer.
- Include all pertinent coordinating instructions listed in the supported-unit order.

Figure C-6c. Sample engineer-unit OPORD

- Do not list SOP orders unless needed for emphasis or changed due to the mission.
- May include reporting requirements common to two or more units if not covered in *Signal* paragraph.
- May authorize direct coordination between subordinate or adjacent engineer-specific tasks.
- Give the time that task organization is effective.

4. SERVICE SUPPORT.

a. General Concept of Logistic Support.

- Provide subordinates with the general concept of logistic support for units under the force engineer's control throughout the operation.
- Identify, in general, what the primary and backup (emergency) means of subunit sustainment are for each type of engineer unit under the force engineer's control. Must address who (organic battalions under division unit control, corps battalions, special separate companies), how (area support, unit support, supply point distribution, unit distribution), where (corps storage area (CSA), DSA, BSAs, division MSB/FSBs, corps support groups), and what (classes of supply and critical services).
- Be consistent with task organization and command-support relationships.
- Make maximum reference to support-unit CSS graphics.
- List the locations of key CSS nodes as they apply to the concept for logistic support (DSA, FSBs, CSA, combat service group (CSG), ASP/ammunition transfer points (ATPs), and so forth) and planned subsequent locations if they change during the operation.

b. Materiel and Services.

(1) Supply. Do the following for each class of supply:

- List allocation and CSRs for each unit, based on missions.
- Ensure that the unit maintains basic loads.
- State the method of obtaining supplies if different from general concept.
  NOTE: Mission logistics may be different than unit (scheduled) logistics.
- Address any special arrangements or plans to sustain specific engineer mission needs (Class IV and V or Class III push to sustain engineer preparation of defenses).

(2) Transportation.

- List primary, alternate, and *dirty* MSRs during the operation.
- List allocations of division's or corps's haul assets.

Figure C-6d. Sample engineer-unit OPORD (continued)

(3) Services. List the location and the means of requesting and obtaining services for each service.

c. Medical Evacuation and Hospitalization. Indicate the primary and backup means of medical evacuation and hospitalization, to include locations of health-service facilities providing support on area or unit basis, for each type of engineer unit.

d. Personnel.

+ State method of handling EPWs and locations of EPW collection points.

+ State method of receiving mail, religious services, and graves registration for each type unit under engineer-unit control.

e. Civil-Military Cooperation. List the engineer supplies, services, or equipment that the HN provides.

f. Miscellaneous.

5. COMMAND AND SIGNAL.

a. Command.

+ State location of key leaders' and engineer's CPs during the operation and planned movements.

+ State location and planned movements of key supported unit C^2 nodes.

+ Designate a logical chain of command.

b. Signal.

+ Identify any communication/signal peculiarities for the operation not covered in the SOP.

+ May designate critical reporting requirements of subordinates if not covered in coordinating instructions or SOP.

+ Designate frequency modulated NETS subordinates for engineer command and observation and intelligence (O/I). Designate NETS for mission and routine reports.

Acknowledge:

Commander's signature (optional)
Commander's last name
Rank

OFFICIAL:
(Authentication)

Figure C-6e. Sample engineer-unit OPORD (continued)

Annexes: (Possibilities but not limitations)
+ Execution matrix.
+ Intelligence annex.
+ CSS annex.
+ Movement annex.
Overlays:
+ Situation template.
+ Engineer operations overlay: includes supported-unit and engineer's graphics, as necessary.
+ Supported-unit CSS overlay.
+ Supported-unit obstacle plan.
+ Other operations: river crossing, large-scale breach, base-camp/base-cluster defenses.

Distribution:

Figure C-6f. Sample engineer-unit OPORD

Include a brief statement of current enemy and friendly situations, which usually gives the reason for the FRAGO. Update subordinate supported units on the current status of engineer missions, if necessary.

Concept

Give changes to the scheme of engineer operations and the corresponding changes to subunit tasks. Include any changes in the supported unit or engineer-unit commander's intent, if necessary.

Coordinating Instructions

Include changes to Service Support and Command and Signal paragraphs of the current OPORD, if made necessary by the change in scheme of engineer operations.

FM 5-100
27 February 1996

By Order of the Secretary of the Army:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:

. . . (signed) . . .
JOEL B. HUDSON
Acting Administrative Assistant to the Secretary of the Army

01490

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